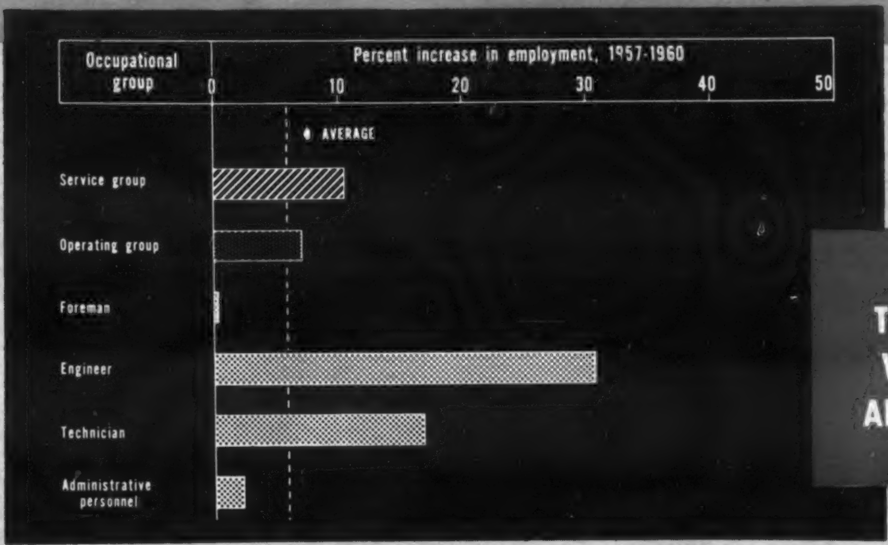
JULY, 1957

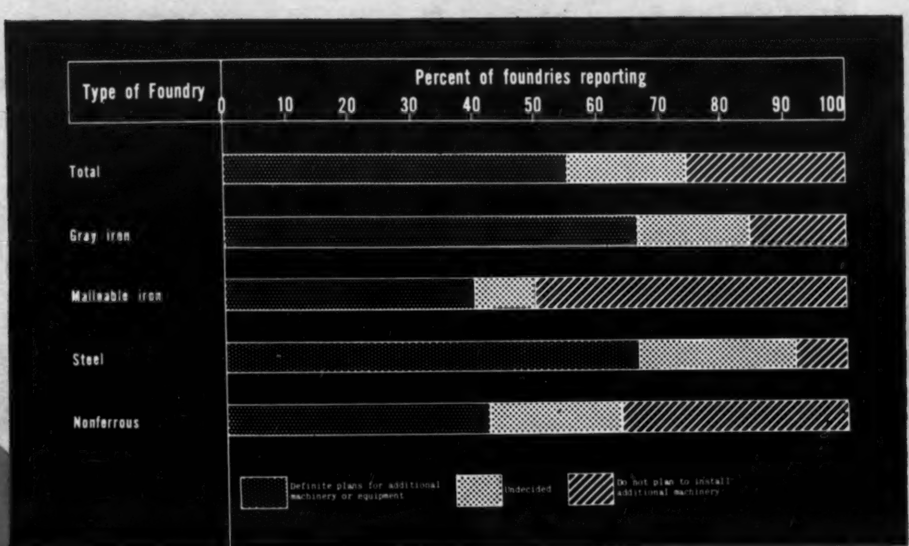
modern castings

THE COMING FOUNDRY MANPOWER SHORTAGE . . .



MORE TECHNICAL WORKERS ARE NEEDED . .

BECAUSE MORE PLANTS WILL MECHANIZE BY 1960



SEE ARTICLE PAGE 24

Owned by THE MEN WHO BUY

Making Better Brass & Bronze Castings

Special 12-page Bonus Section describes control measures for the conditions that produce quality brass & bronze castings

Water-Cooled Cupolas

Speed, economy, and better control of melting resulted when John Deere Tractor Works converted six of its cupolas to water-cooling

Chemical Analysis by X-Ray

General Electric Foundry Dept. meets the demands of increasing production with a device that completes analysis in minutes

Convention Report

Advancing technology of the cast metals industry is recorded in summaries of over 50 papers from the 61st AFS Castings Congress

future meetings and exhibits

JULY

22-23 . . AFS *Finance Committee, Annual Meeting*. Union League Club, Chicago.

26 . . Malleable Founders' Society, *Western Sectional Meeting*. Drake Hotel, Chicago.

AUGUST

8-9 . . AFS *Annual Board Meeting*. Hotel Sherman, Chicago.

19-24 . . *24th International Foundry Congress*, Arranged by Swedish Foundrymen's Association. Parliament Bldg., Stockholm, Sweden.

SEPTEMBER

8-13 . . American Chemical Society, *Fall Meeting*. New York.

17-20 . . American Die Casting Institute, *Annual Meeting*. Edgewater Beach Hotel, Chicago.

23-24 . . Steel Founders' Society of America, *Fall Meeting*. The Homestead, Hot Springs, Va.

23-26 . . Association of Iron & Steel Engineers, *Exposition*. Sheraton Hotel, Pittsburgh, Pa.

27-28 . . AFS *Missouri Valley Regional Conference*. Missouri School of Mines and Metallurgy, Rolla, Mo.

OCTOBER

2-3 . . AFS *Michigan Regional Foundry Conference*. Kellogg Center, East Lansing, Mich.

9-11 . . Gray Iron Founders' Society, *Annual Meeting*. Drake Hotel, Chicago.

12-13 . . Conveyor Equipment Manufacturers Association, *Annual Meeting*. Grand Hotel, Point Clear, Ala.

17-18 . . Magnesium Association, *Annual Convention*. The Biltmore, New York.

17-19 . . Foundry Equipment Manufacturers' Association, *Annual Meeting*. The Greenbrier, White Sulphur Springs, W. Va.

18-19 . . AFS *New England Regional Foundry Conference*. Massachusetts Institute of Technology, Cambridge, Mass.

18-19 . . AFS *Northwest Regional Foundry Conference*. Hotel Vancouver, Vancouver, B.C.

21-25 . . National Safety Council . . *45th National Safety Congress and Exposition.* Conrad Hilton Hotel, Chicago.

24-25 . . AFS *Niagara Frontier Regional Foundry Conference.* Statler Hotel, Buffalo, N. Y.

25-26 . . National Management Association, *Annual Meeting.* Penn-Sheraton Hotel, Pittsburgh, Pa.

31-Nov. 1 . . *10th Annual Purdue Metals Casting Conference.* Purdue University, Lafayette, Ind.

NOVEMBER

3-8 . . American Society for Metals and Society for Non-Destructive Testing . . *2nd World Metallurgical Congress & 39th Annual National Metal Congress.* Morrison Hotel, Chicago.

7-8 . . National Foundry Association, *Annual Meeting.* Waldorf-Astoria Hotel. New York.

11-13 . . Steel Founders' Society of America, *Twelfth Technical and Operating Conference.* Carter Hotel, Cleveland.

DECEMBER

3-4 . . Foundry Facings Manufacturers Association, *Annual Meeting.* Hotel Waldorf-Astoria, New York.

4-6 . . American Institute of Mining, Metallurgical and Petroleum Engineers, *Electric Furnace Steel Conference.* Penn-Sheraton Hotel, Pittsburgh, Pa.

5-7 . . National Association of Manufacturers, *Annual Meeting.* Waldorf-Astoria Hotel, New York.

Wetting Agents Promote Better Wash Penetration

Wetting agents, used for many years in a variety of industries for a number of years, are being used in increasing quantities in the foundries. Used in core and mold washes, it prevents burning-in of sand, increases wash penetration, and produces a smoother finish.

Wetting agents improve the characteristics of these washes, according to Aquadyne Corp., by lowering the surface tension of water so it penetrates below the sand surface and carries refractory particles with it. Such washes have better adherence, do not flake or peel when heat is applied, and are not subject to heat checks and erosion when the mold is poured.

The penetrating action of wetting agents can be observed by dipping a pin core into a solution of one part wetting agent to 1000 parts of wash, drying, and breaking.

Johannes C. A. Croning of Shell Molding Fame Dies

Johannes Carl Adolph Croning, developer of shell mold process and 1957 winner of AFS Penton Gold Medal Award, died at the age of 70. Funeral services were held May 16 at Nienstedt, Germany.

Mr. Croning was born in Hamburg, Germany. He attended the School for Mechanical Engineering there, and became interested in cylindrical locks and started his own company to produce them. From this groundwork in molding and casting procedures he developed the shell mold process, founding the firm of Croning & Co. and the firm Mikroforma for experi-

ments and training. He obtained several patents, then experimented with water-soluble, synthetic resins as binding agents, receiving a patent in 1944 for a new molding process using a fluidized, hardenable sand-synthetic resin mixture. War conditions prevented the use of synthetic resin and experiments were discontinued again and again.

Later he introduced silicone oils as a parting compound, making possible the production of molds for ribbed cylinders, and in 1948 large-scale operations were put into effect at the high-frequency crucible steel plant, which is the present Bochum plant of the German High-grade Steel Works, Inc.

List Metallizing Symbols

Standard metallizing symbols specifying the extent and nature of each operation have been prepared by the American Welding Society and the Canadian Government Specifications Board. This booklet may be purchased from the American Welding Society, 33 W. 39th St., New York 18.

The publication covers surface preparation, supplementary symbols, and a section on their application.

july, 1957
vol. 32, no. 1

modern castings

in this issue

regular departments

FOUNDRY TECHNICAL CENTER, Golf & Wolf Roads, Des Plaines, Ill.
VAnderbilt 4-0181

MODERN CASTINGS is indexed by Engineering Index, Inc., 29 West 39th St., New York 18, N. Y. and microfilmed by University Microfilms, 313 N. First St., Ann Arbor, Mich.

Published monthly by the American Foundrymen' Society, Inc., Golf & Wolf Roads, Des Plaines, Ill. Subscription price in the U.S., $5.00 per year; elsewhere, $7.50. Single Copies 50c. May and June issues $1.00. Second-class mail privileges authorized at Pontiac, Illinois. Additional entry at Des Plaines, Ill.

Show Time Is Coming

■ **From all points** of the compass foundrymen will converge on Cleveland for the 62nd Castings Congress and Show of the American Foundrymen's Society, May 19-23, 1958. All preliminary information indicates that this will be the largest Show in the history of the industry. Over 350 exhibitors will occupy more than 115,000 sq ft of floor area in the Cleveland Auditorium. Attendance is expected to exceed the all-time record of 18,000.

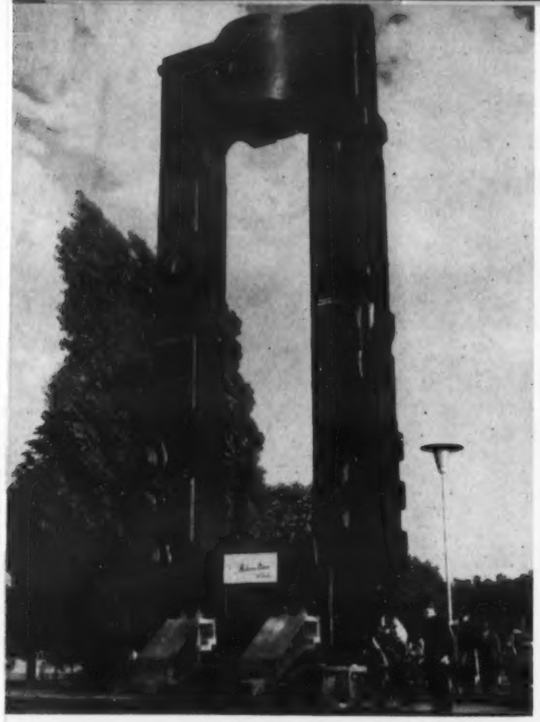
Compared with previous years this Show will feature more displays of the latest equipment available for mass production of quality castings than ever assembled before under one roof. The growing trend toward mechanization of foundry processes and materials handling has led to rapid changes in design of equipment available since the previous exhibit in Atlantic City.

More suppliers will be on hand to demonstrate their improved materials so necessary to producing better castings. Foundrymen will have this once-in-two-years opportunity to observe and evaluate all the new processes and new materials that are coming into the industry at an ever increasing rate.

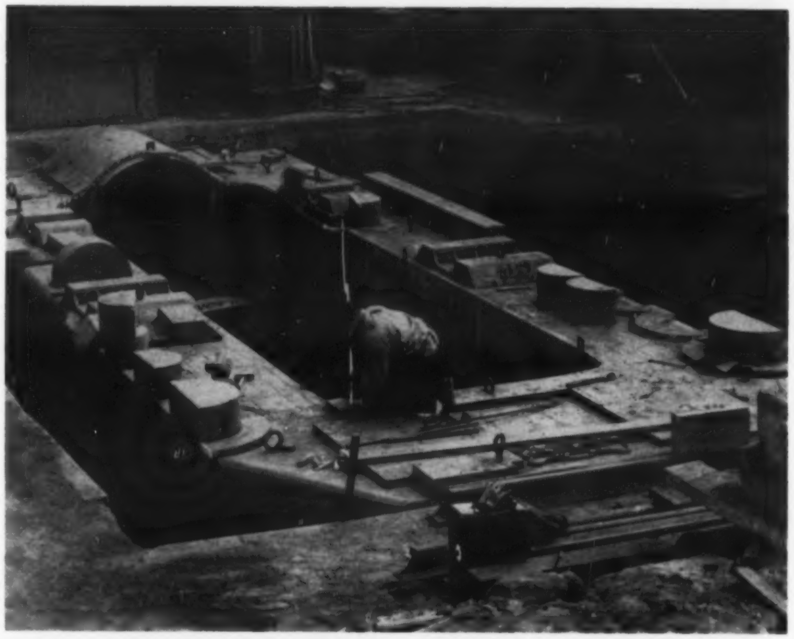
Concurrent with the Show will be the equally important Technical Program. Close to 100 important papers authored by over 150 of the top men in the industry will cover a wide variety of subjects of current interest to every man involved in the castings industry. The week-long program will also include shop courses, round table luncheons, plant visits, and progress reports on AFS sponsored research. The tentative schedule of technical sessions has malleable iron, steel, safety, hygiene & air pollution, patternmaking, and fundamental research scheduled for Monday and Tuesday; light metals and sand each day of the week; gray iron on the last three days of the week; brass & bronze, heat transfer, education, and industrial engineering on Thursday and Friday.

Business meetings, social gatherings, and a special program for the ladies will be woven into the busy week's aggenda.

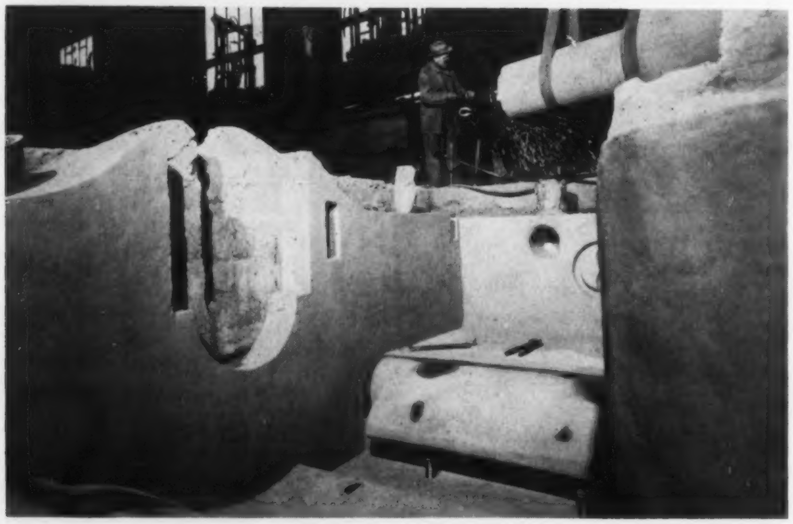
In August potential exhibitors will receive applications along with official brochures giving all the necessary details for entering the Show. Requests for space are already being received, including companies that have never previously exhibited in the Castings Show. Space assignments will not be made until after November 1.



Largest and heaviest rolling mill housing in the world is this steel casting produced by Bochumer Verein in the German Ruhr valley industrial city of Bochum. Massive steel casting is 37.5 ft high and 14.5 ft wide. Casting was a featured attraction of the 1956 International Foundry Trade Fair in Dusseldorf. Pictured are major steps in the production of the casting.



The rail-bed was covered with molding sand and four major pieces of the pattern were placed in the pit and assembled. Final assembly of the pattern was then completed.



Mold ready for assembly. Mold was dried and coated with refractory wash. Molder is using a cutting torch to trim core to final fit.

modern castings album

380 tons of molten steel were poured into the mold in 15 minutes. Five furnaces were tapped simultaneously to provide the metal. One of the five bottom-pour ladles shown is pouring directly into the mold while the others are pouring into runners leading to the mold.

pouring off the heat

come back soon!

▪ After the Chilean Iron and Steel Foundry Productivity Team had finished the very interesting trip by the eastern and central regions of the United States, that the International Cooperation Administration prepared for us with your collaboration, we returned to Chile with beautiful souvenirs and a lot of very valuable information. We want to thank you for all you did to arrange an instructive visit to your country.

M. JEANNERET
Santiago, Chile

glad to have you!

▪ I am a sophomore in mechanical engineering and after reading the latest copies of MODERN CASTINGS I have become extremely interested in the foundry field. I am enjoying your publication very much and intend to keep up my subscription indefinitely.

JON HOCKENYOS
University of Illinois

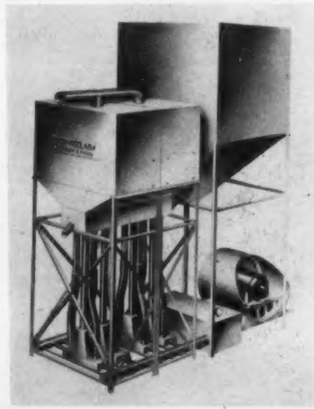
Richard L. Olson, president, Dike-O-Seal, Inc., Chicago, will present a paper entitled *"Engineering Aspects of Core Box Design"* at the 24th International Foundry Congress to be held August 19-24 in Stockholm, Sweden. Mr. Olson, left, is shown receiving the Gold Medal Diploma, awarded by the 6th International Inventors Exhibit held recently in Brussels, Belgium. Presenting the award is Otto A. Witt, United States representative of the International Inventors Exhibit.

products and processes

CO_2 process binder is said to react quickly with CO_2 when cores are gassed, resists tendency to be viscous or gummy, promotes maximum collapsibility and minimum of grain shedding, and packs or blows with excellent density. Bulletin F-130 recommends percentages of binder for various AFS sand fineness. *Frederic B. Stevens, Inc.*

Circle No. 1, Page 7-8

Foundry sand reclamation system uses pneumatic scrubbers. Unit and auxiliary equipment can be integrated into overhead sand handling and storage systems of large foundries. Package unit, serviced by front end-loaders, available for small foundries without overhead systems. This unit requires 14x17 ft floor space and 21 ft head-room. Gravity feed is used. Bulletin 2000 details installation, operation, and maintenance procedures. *Beardsley & Piper Div., Pettibone Mulliken Corp.*



Circle No. 2, Page 7-8

Coated crucibles for aluminum melting have protective chemical inner face coating that resists dross adherence. Crucibles must be cleaned after each heat, but dross does not adhere as tightly. Reduces dross accumulations which frequently cause crucibles to crack and leak before wearing out. *Electro Refractories & Abrasives Corp.*

Circle No. 3, Page 7-8

Plastic casting material reportedly can be cast in any thickness yet possesses low shrinkage. Exothermic heat in any thickness, it is claimed, will not exceed 200 F. *Furane Plastics, Inc.*

Circle No. 4, Page 7-8

Pattern mill for wood and non-ferrous metals has spindle speeds from 1000 to 6000 rpm and compound table movements. Performs recessing, machining outside or inside edges of straight or curved work, champfering, half lapping, and panel raising. Spindle is carried in balanced sleeve and has 6-in. vertical adjustment. Table has 30-in. longitudinal traverse by rack and pinion, and 18-in. transverse movement by handwheel and screw. Table may be rotated 45° either way. *Freeman Supply Co.*

Circle No. 5, Page 7-8

Brinell hardness testing machine, motorized, automatically projects magnified image of ball impressions on cali-

brated screen. Test cycle is infinitely variable from 6 to 60 sec. Limit stops on screen allow operator to see whether or not sample meets specifications. Bulletin A-15 illustrates Brinell indentation as seen by operator and describes operation. *Testing Machines Div., Gries Industries, Inc.*

Circle No. 6, Page 7-8

Tractor-shovel, 12 cu ft capacity, performs such foundry operations as moving sand, hauling castings, and clean-up. Full-reversing mechanism transmission provides two speeds in

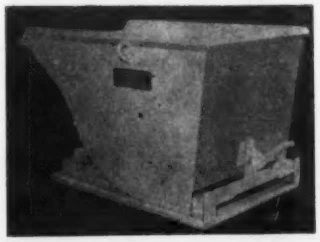
each direction. Power bucket-closing permits dumping over hopper and bin edges up to 68 in. *Frank G. Hough Co.*

Circle No. 7, Page 7-8

Hydro clamp scoop attachment for fork lift trucks handles fibrous materials without sides on the blade. For granular materials or small metal pieces, steel side plates are bolted to the side arms of the clamp bar. Blade is rotated by its own hydraulic cylinder. *Materials Transportation Co.*

Circle No. 8, Page 7-8

Hoppers, self-dumping, handle wet or dry, cold or hot bulk materials. Automatically dumped by gravity cam



latch; after dumping, unit rights itself. Five models, ½-yd. to 2-yd capacities. *Apex Welding & Fabricating Corp.*

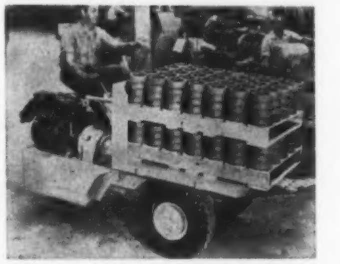
Circle No. 9, Page 7-8

Dielectric sand core oven reduces core baking to minutes with saving in handling, mulling, and cleaning time. Said to bake evenly despite differences in core height or section without over-burning or under-curing. Bulletin 15B-7306D explains operation of dielectric oven, lists typical

sand mixes with resin binders, and shows manufacturers and trade names of thermosetting synthetic resins. *Allis-Chalmers Mfg. Co.*

Circle No. 10, Page 7-8

Flatbed truck, hydraulic torque converter drive, has top speed of 12 mph. No belts or chains used in driving; smooth starts and acceleration



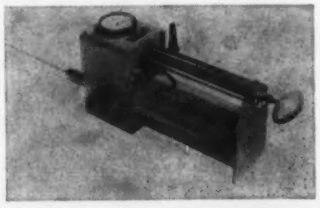
eliminates spillage or shifting of stacked materials. Two size beds available, 42x42 and 42x60 in. *Prime-Mover Co.*

Circle No. 11, Page 7-8

Lubricant for open gears is non-melting, non-freezing, non-soluble lubricant. May be applied by hand or gun. Made from refined mineral oil bases with special extreme-pressure agents to give adhesiveness. Said to last 4-times longer. *Warren Refining & Chemical Co.*

Circle No. 12, Page 7-8

Fluidity tester for molten metals provides quick and reliable means of testing by using a controlled partial vacuum to pull a sample of metal into a pyrex tube. The uncontaminat-



ed sample may be used for chemical analysis if desired. Unit is self-contained and portable. *Harry W. Dietert Co.*

Circle No. 13, Page 7-8

Slip jackets, available in five sizes, feature sides and ends which line up with the sides of mold allowing quick installation on molds without crushing. *Cape Mfg. Co.*

Circle No. 14, Page 7-8

Electrical resistance heaters using stainless sheath cartridge heating elements are available in a variety of diameters, length, and watt densities for automatic shell blowing machine.

Also available are cast aluminum heater platens for use in blowing shell cores or shell molds. *C & S Products Co.*

Circle No. 15, Page 7-8

Immersion thermocouple measuring up to 3100 F, utilizes a metal-ceramic secondary protection tube, a vitrified alumina primary tube, and a platinum-platinum 10 per cent rhodium thermocouple. Secondary tube

gives longer life with fast response and resistance to thermal shock. Curved stainless steel tube of any required length leads to a wooden grip and thermocouple assembly head. *Bristol Co.*

Circle No. 16, Page 7-8

Creep-rupture testing machine, 12,000 lb. capacity, uses limited floor space by eliminating lever-arm with dead-weight hydraulic loading directly on specimen. Uses split furnace (1800 F. max temp.) sealed at the bottom to prevent stack effect. Power requirements; 110 v, 60 cycle, 1100 watts. *Tatnall Measuring Systems Co.*

Circle No. 17, Page 7-8

Metal protective dip coating protects parts subject to rust, corrosion, dirt or shipping damage. Plastic coating cushions castings from shock and breakage, resists acids, alkalis, and

solvents and will not absorb moisture. Coating may be peeled off by hand. *Chemical Processing Div., Auburn Button Works, Inc.*

Circle No. 18, Page 7-8

Flame-retarder for wooden bottom boards and flasks, promotes additional life. Two or three coats impregnate and insulate giving uniform protection. Product is colorless, odorless, and non-irritating. *Foundry Rubber, Inc.*

Circle No. 19, Page 7-8

Protective coating for stainless steel finishes during handling and storage

has met the following requirements according to manufacturer; 120 hr in weatherometer at 140 F; exposure to rain, sleet, sand, and smoke; in-plant handling hazards; and hazards from shipping and outdoor storage. *Onco Products Inc.*

Circle No. 20, Page 7-8

Continuous production furnaces are being installed in Georgia plant for continuous production of aluminum rod of electrical conductor grade. Use

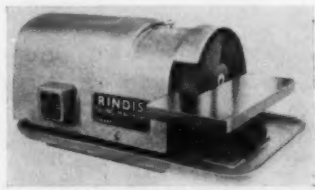
of fuel and induction methods of melting will allow comparison of two systems. *Continental Industrial Engineers, Inc.*

Circle No. 21, Page 7-8

Zinc brightener used in plating parts by barrel method is said to eliminate subsequent bright dipping. Gives an underseal protecting parts from rust and corrosion and a foundation for chromate finishing and bonderizing. Plating current ranges from 60 to 90 amperes per sq ft. *Smoothex Inc.*

Circle No. 22, Page 7-8

Filing machine removes metal 5-6 times faster than hand filing without coolant or redressing. Designed for use on castings, metal and wood pat-



terns. Filing discs and rings with many teeth arrangements made for various speeds and materials. *Newage Industries, Inc.*

Circle No. 23, Page 7-8

Truck bumpers, rubber-coated fabric, may be mounted anywhere on

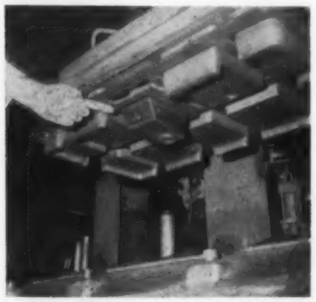
body. Bumpers may be reversed to double life. Available in three sizes. Protects truck bodies, bed platforms, docks, loads, and plant equipment. *Bumpers, Inc.*

Circle No. 24, Page 7-8

Catalytic exhaust units for industrial trucks are said to reduce carbon monoxide concentration in enclosed areas so that after eight hours of operation CO emission had no perceptible effect or personnel. *Oxy-Catalyst, Inc.*

Circle No. 25, Page 7-8

Rubber pouring basin former is said to aid in eliminating swirl of molten metal causing slag to float, and prevents slag from entering mold cavity. In use, the down sprue pin is wiped clean as the jolt table rises. This



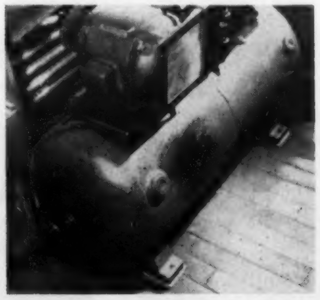
wiping action eliminates cutting and blowing out the sprue, keeping the pouring basin free of loose sand. Device eliminates manual cutting of the sprue and is self-releasing. *Keson Industries.*

Circle No. 26, Page 7-8

Blueprint vertical filing system uses friction type binders eliminating holes and staples. Includes storage space for holding related specification literature. *Plan Hold Corp.*

Circle No. 27, Page 7-8

Vibration pad for holding machinery to floor without bolting. Molded from reinforced fiber glass and vinyl resin.



Suction cups in parallel surfaces holds without adhesives. Resists oil, soap, detergents, water, bases and salts. *Bullard Clark Co.*

Circle No. 28, Page 7-8

Dust collector, for woodworking and metal grinding operations, is an air

recirculating type requiring no outside exhaust outlet. Unit has air capacity of 2405 cfm and dust storage capacity of 6 cu ft. Particles are separated by cyclone principle and precipitated into bin located at base. Bag is cleaned by shaking. *Aget Mfg. Co.*

Circle No. 29, Page 7-8

Micro valve for air, gas, oil and water services. Has 3-way, 2-position valve. Operating pressures range from 0-100 psi. May be used in place of limit switches and control main hydraulic or pneumatic operated valves. *Barworth, Inc.*

Circle No. 30, Page 7-8

Magnetic particle inspection supplies, instruments, and systems. Included are four powders, two colors of paste and fluorescent paste and powder; bulb-type powder dispensers; colored inspection tapes, tags and dispensers; and gun-type powder blower. *Electrical Div., American Box & Cabinet Co.*

Circle No. 31, Page 7-8

Railroad car shaker derives action from eccentric rotation of unbalanced shaft at 1800 rpm. Said to be particularly effective in starting rapid material flow from hopper openings. Unit attaches to side of car with vibrator located at upper end. *Eastern Constructors, Inc.*

Circle No. 32, Page 7-8

Fork lift truck features 4-way hydraulical tilting and leveling. Unit mounted on crawler tractor is capable of lifting 15,000 lb. to 14 ft. Fork lift is interchangeable with front-end loader attachment. Tilting mechanisms effect smooth pickups of heavy and unwieldy loads regardless of slope. *Eimco Corp.*

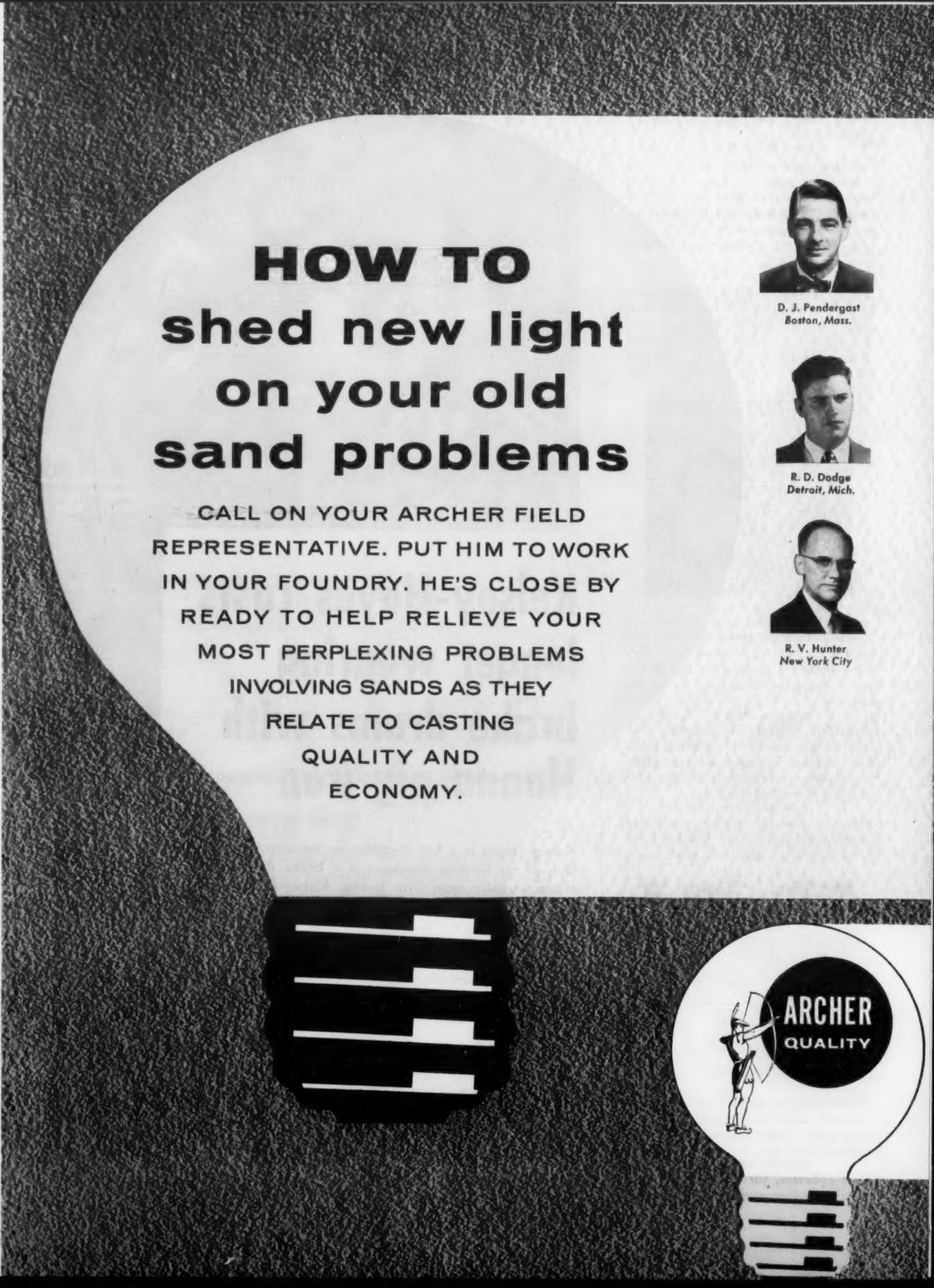
Circle No. 33, Page 7-8

CO_2 shielded welding process for mild steel eliminates flux. Use of bare fillerwire and gas simplifies operations, eliminates problems related to slag inclusion, flux removal and recovery. Deposition rates are greatly increased over other consumable electrode methods, it is reported. *General Electric Co.*

Circle No. 34, Page 7-8

Shell core blowing unit, automatic, all-pneumatic, is five-station, rotary-index machine producing up to 300 complete cycles per hour. Cores are cured, stripped, and delivered on each cycle. After blowing, core boxes are indexed to first of three heat-controlled curing stations within the

Circle No. 129, Page 7-8



furnace. Automatic blowing unit, stripping station, and transfer table are fully adjustable for different height core boxes. *Beardsley & Piper Div., Pettibone Mulliken Corp.*

Circle No. 35, Page 7-8

Dust collectors, 2 types, use centrifugal force for air cleaning. One model designed for dust size above 44 microns, the other under 44 microns. Two types may be used in combination where bulk and fine dust both must be handled. *Kirk & Blum Mfg. Co.*

Circle No. 36, Page 7-8

CO_2 Arc Welding Shield Promotes Better Results

Carbon dioxide, already important to foundries for the hardening of cores and molds, appears to be assuming a second important function in the castings industry. This relatively cheap gas is now being used to surround the electric arc during welding and salvage of steel castings. The principles of this process were described by John J. Chyle, A. O. Smith Corp., Milwaukee, at the 61st Castings Congress held during May at Cincinnati.

Several welding equipment manufacturers are now producing automatic and semi-automatic equipment for this consumable-electrode, gas-shielded process. The success of the process is derived from the use of CO_2 gas which protects the work from atmospheric contamination. Previously more expensive gasses such as argon or helium had been used for shielding. Utilizing CO_2 has greatly reduced the cost of a protective atmosphere.

The use of a special welding electrode or feeder wire and the shielding gas simplifies operations and eliminates problems ordinarily associated with slag inclusion and flux removal and recovery.

The process is said to have the following advantages over normal arc welding: higher and more stable arc, greater penetration, faster deposit, less spatter, and better visibility.

Contributing to the speed of deposit are the greater visibility and the light weight, less than 2 lb, for the semi-automatic gun.

Less training is said to be required to produce skilled operators. One manufacturer states that with semiautomatic equipment a novice in one day can be taught to do welding of quality equal to that of a man who has been instructed for one month in manual welding.

Circle No. 129, Page 7-8

committees in action

■ Bids are to be received from universities on study and research on a new project, "Production of Heavy Section Malleable Iron," sponsored by the Malleable Division. The project will be started in January, 1958.

At the May 6 Division meeting held in Cincinnati, a report was given on the recently completed projects on melting malleable iron. It was agreed that the 1958 Convention program for the division should include two technical sessons, two shop courses, and a round-table luncheon.

Officers were elected for the Malleable Division at the Cincinnati meeting. They are: chairman, Eric Welander; vice-chairman, Fred Jacobs.

Lyle Jenkins has replaced Fred Jacobs as chairman of the Controlled Annealing Committee. This committee provided a shop course session for the 1957 Convention and are continuing their work on the Symposium of Annealing.

The Pearlitic Malleable Committee has presented their second report on the comparison of liquid- and air-quenched pearlitic malleable. Subcommittees are studying machinability, ductility, impact properties, and hardenability of pearlitic malleable iron.

■ Progress on the Refractories Manual was reviewed at the May meeting of the Refractories Manual Committee meeting held in Cincinnati. Assignments were made for the book which will include sections on fundamentals, manufacture, tests, applications, and a glossary. Applications were discussed for melting furnaces, side-blown converters, crucibles, cupolas, electric furnaces, open flame, and open hearths.

■ Officers for the Gray Iron Division were nominated at the May meeting held in Cincinnati. H. W. Lownie was nominated for chairman, R. A. Clark for vice-chairman, and J. E. Foster for secretary.

The division's Program and Papers Committee was enlarged to give broader representation. Mr. Lownie summarized the division's program for the 1957 Convention and stated that several papers appeared to be available for the 1958 Convention.

Future plans to further simplify riser design data and calculations were

outlined in the Research Committee report. It was suggested that consideration should be given to developing a nomograph for the calculation of riser sizes. Future plans of the committee also include the possibility of developing a motion picture to demonstrate the mechanics of gating and risering for chapter and plant showings.

▪ Three committees were formed, future training courses reviewed, and tuition fees established by the trustees of the American Foundrymen's Society Training and Research Institute, meeting May 7 in Cincinnati.

B. C. Yearley, National Malleable & Steel Castings Co., is chairman of the building committee. Other members are Hyman Bornstein, retired; Frank W. Shipley, Caterpillar Tractor Co.; and Burton L. Bevis, Caterpillar Tractor Co.

L. H. Durdin, Dixie Bronze Co., Inc., is chairman of the finance committee. Other members are Hyman Bornstein; Harry W. Dietert, Harry W. Dietert Co.; and Wm. W. Maloney, AFS general manager.

Hyman Bornstein is chairman of the research committee. Other members are R. F. Thomson, General Motors Corp.; and S. C. Massari, AFS technical director.

European Furnace Available

A 60-cycle, coreless induction melting furnace, developed in Europe, is available in this country through a licensing agreement. The furnace features electro-magnetic stirring of the molten metal said to produce excellent results in the production of

high quality cast iron, recovery of iron turnings, and recovery of aluminum metal.

The furnace uses a cylindrical induction coil surrounding a crucible-shaped refractory lined hearth. Capacities range from one to ten tons, rated from 200 kw to 1500 kw.

let's get personal

Bradley B. Evans . . sales manager of Empire Steel Castings, Inc., Reading, Pa., has been elected president of the National Castings Council. Mr. Evans retired last month as president of the Alloy Castings Institute. He has been in the castings industry for 30 years and has been sales manager of Empire since 1940.

Eugene Caldwell . . has been elected president of Baker-Raulang Co., Cleveland. He was formerly vice-president and general manager of Hyster Co., Portland, Ore.

Willard C. Suttles . . has been appointed sales representative for Beardsley & Piper, Div. of Pettibone Mulliken Corp. Mr. Suttles will cover portions of Michigan, Ohio, and Kentucky. Prior to his new appointment he was with Hill & Griffith Co.

A. A. Glueck . . former general manager of the eastern department of Federated Metals Div., American Smelting and Refining Co., has been named general manager of the midwestern department. **L. D. Alpert,** manager of the company's Los Angeles plant has been named to fill Mr. Glueck's former position.

William S. Boonenberg . . former general supervisor of the laboratory at Saginaw Malleable Iron Plant, Central Foundry Division, General Motors Corp., has been named chief metallurgist for General Motors do Brasil. He will be responsible for all metallurgical functions of the new GM foundry at Sao Jose do Campos, Brazil.

A. D. R. Fraser . . president of Rome Cable Corp., Rome, N.Y., has been elected to the board of Crouse-Hinds Co., Syracuse, N.Y.

R. C. Stokes . . has been named general manager of Crown Non-Ferrous Co., Chester, Pa. He was formerly plant manager, Philadelphia Bronze and Brass Corp.

Charles D. Preusch . . has been promoted from foundry metallurgist to chief metallurgist for the Spaulding Works, Crucible Steel Co. of America, Harrison, N.J.

Edward E. Slowter . . former secretary and business manager of Battelle Memorial Institute, Columbus, Ohio, has been named vice-president of the research organization.

Frank G. Hough Co., Libertyville, Ill., has announced the retirement of **Frank G. Hough,** company founder and board chairman. The company also has elected **T. F. Flood,** vice-president, to the board.

AFS Malleable Division has elected **Eric Welander,** John Deere Malleable Iron Works, East Moline, Ill., as chair-

Bradley B. Evans

Willard C. Suttles

R. C. Stokes

man and **F. W. Jacobs,** Texas Foundries, Inc., Lufkin, Tex., a vice-chairman. Mr. Jacobs has resigned as chairman of the division's Controlled Annealing Committee and **Lyle R. Jenkins,** Wagner Malleable Iron Co., Decatur, Ill., has been appointed to succeed him.

Wheelabrator Corp., Mishawaka, Ind., has elected company founder **Verne E. Minich** as honorary chairman of

Verne E. Minich

the board and has elected **Otto A. Pfaff** as chairman. Mr. Pfaff will continue to serve as president, a position he has held since 1941.

Otto A. Pfaff

Chester L. Mack . . has joined the supervisory staff of Johnson Bronze Co., New Castle, Pa. Mr. Mack was formerly associated with Chautauqua Hardware Corp., Jamestown, N.Y.

E. L. Miller . . has been named president and general manager of Cooper-Bessemer Corp., Mt. Vernon, Ohio. At the age of 38, Mr. Miller is the youngest president to head this 124-year old engine and compressor building firm.

Irving B. Hexter, president of Industrial Publishing Corp., and **Robert R. Miller,** president of Precision Metalsmiths, Inc., were honored at the spring meeting of the Investment

Circle No. 133, Page 7-8

the editor's field report

by Jack Schaum

Don't Blame Epoxy: One of the oft-repeated criticisms aimed at the use of epoxy resins in pattern making is that it causes dermatitis. It is true that some people are allergic to epoxy resins but in many cases the skin rash results from the use of harsh alcohol and acetone type solvents.

These solvents are commonly used to remove the resin from the skin or from tools and other equipment in the shop. The solvents remove protective body oils from the hands leaving them very dry and susceptible to chapping and cracking. This condition has often been mistakenly identified as an allergy to epoxy.

These harmful drying solvents can now be avoided by using recently developed cream type resin solvents or removers which contain lanolin for protection of the skin. After removing all adhering epoxy from hands with the cream it is readily rinsed off with water leaving the hands clean and soft. Use of such a cream should help determine if the employee's skin rash is coming from the solvent or the epoxy. If the latter, he will have to await the development of non-dermatitic epoxy which I am told is on its way.

Is Co_2 Necessary? Maybe not. Some interesting research has recently indicated the rather remarkable fact that sodium silicate bonded cores can be hardened by gassing with dry air or dry nitrogen. The complete story on this rather startling discovery will be forthcoming in MODERN CASTINGS next month!

Water-Cooled Cupolas: In this issue of MODERN CASTINGS you can learn how the John Deere Waterloo Tractor Works converted their conventional cupolas over to external water cooling. The advantages derived are almost enough to convince the most skeptical that the water-cooled cupola is destined to play an important role in the advancing technology of melting iron. It has been said that the first water-cooled cupola came into being when a resourceful operator squirted water from a hose onto a hot spot that developed in the cupola shell at a point where the lining had burned too thin.

Current modifications of this technique use a continuously operating spray ring that distributes water uniformly around the periphery of the cupola shell near the top and gravity does the rest. Of course there are a few other complications which are solved in "How We Converted to Water-Cooled Cupolas." The extent of this development is apparent in the list appearing in this issue showing over 60 plants operating water-cooled cupolas.

Casting Through the Ages: Several months ago MODERN CASTINGS made available to its readers a number of the original drawings made by the artist, Al Reetz, for *Casting Through the Ages*. We were pleased with the flood of requests and comments received.

Joseph F. Best wrote from Philadelphia that each month he clips *Casting Through the Ages* and uses it to add interesting highlights to foundry courses he is teaching.

From Hamilton, Ontario, Neil A. Forsyth wrote for the orginal *Casting Through the Ages* drawing which dealt with the production of "Carronades" in Scotland. It seems his father served his apprenticeship at the Carron Iron Foundries and had just returned from a visit to the old establishment. Fortunately, we had this one on hand and were able to send it along to him.

Another ardent "fan" of this feature cuts them out each month for mounting in an interesting scrap book kept for his sons.

Perhaps you have found some other use for these historical items. If so let us know about it. Anyone still wishing to participate in our April offer to send you an original drawing, just mail a request to the Editor. We still have a few left.

Modern Castings Index: A complete index of subjects and authors appearing in the 1956 issues of Modern Castings has been prepared. You will find this handy reference invaluable when trying to remember where you read the answer to some current problem or what articles you should read for background information on some particular phase of foundry operations. The index is available at no charge. So write MODERN CASTINGS for your free copy today.

Continued from page 18

Casting Institute for their individual contributions to the organization.

W. A. Dean . . has been named assistant development metallurgist for Aluminum Co. of America. Dr. Dean was formerly chief metallurgist for Alcoa's Cleveland works.

Herbert J. Niemann . . has been appointed Chicago area sales engineer

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for Pangborn Corp., Hagerstown, Md. He was formerly vice-president of Hydro-Blast Corp.

E. M. Van Winkle . . has been appointed general manager of Magnus Metal Div. of National Lead Co. He continues as president of Magnus Metal Corp.

Albert H. Foster . . has been named vice-president and director of the New York office of Lester B. Knight & Associates, Inc. Mr. Foster recently

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resigned as president of Mead Carney & Co., Inc., and vice-president and director of First Research Corp. to accept his new post.

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for the asking

■ including free films

Vibrator catalog, 10 pp, lists electric models adjustable for heavy and light duty material for moving and emptying bins and eliminating plugging or stoppage. Portable or fixed types include eccentric-weighted and pulsating electro-magnetic. *Cleveland Vibrator Co.*
For Manufacturer's Information Circle No. 61, Page 7-8

How to braze stainless steel is described in 8-p technical reprint. Covers filler materials, cleanliness, clearances, wetting, fixtures, distortion, heating, cooling and atmosphere protection. *General Electric Co.*
For Manufacturer's Information Circle No. 62, Page 7-8

Plant engineering, modernization, mechanization, and materials handling are discussed in bulletin describing services. *Lester B. Knight & Associates, Inc.*
For Manufacturer's Information Circle No. 63, Page 7-8

Flask pins and bushings, both round and hexagon are described in data sheet. Pins are hardened, ground, and hard-chrome plated. *The Adams Co.*
For Manufacturer's Information Circle No. 64, Page 7-8

Aluminum alloy brochure, in new handy file folder style, gives chemical composition, typical properties, government specifications, and applications for alloy 417. *Apex Smelting Co.*
For Manufacturer's Information Circle No. 65, Page 7-8

Airless blast equipment bulletin, 8 pp, gives case histories on automatic deburring, cleaning, and finishing operations using various machines and abrasives. *Wheelabrator Corp.*
For Manufacturer's Information Circle No. 66, Page 7-8

Pressure regulators for industrial compressed gases are described in 40-p catalog. Included are diagrams and operating details of various types of cylinder, manifold, and pipeline regulators, both single- and two-stage; also specialized equipment such as laboratory and metering regulators and gas proportioners. Flow and pressure charts in graph form give performance data *Air Reduction Co.*
For Manufacturer's Information Circle No. 67, Page 7-8

Fume control of electric furnaces solved by using cloth-tube type collectors. Problems of small particle size fume, hot and corrosive nature of electric furnace gases are covered in 8-p booklet. *Wheelabrator Corp.*
For Manufacturer's Information Circle No. 68, Page 7-8

Abrasive chips and media for barrel finishing of ferrous and non-ferrous

castings are described in 4 pp brochure. Lists recommendations for various production jobs. *Macklin Co.*
For Manufacturer's Information Circle No. 69, Page 7-8

Belt conveyor catalog, 8 pp, describes line of belt conveyor idlers including troughing, flat, self-aligning, rubber disk, and return designs in 4,- 5,- and 6-in. diameter rolls with "sealed for life" bearings. *C. O. Bartlett & Snow Co.*
For Manufacturer's Information Circle No. 70, Page 7-8

Melting furnace catalog, 36 pp, displays ferrous and non-ferrous melting models including stationary, tilting, holding, reverbatory, barrel, and special types. Units are fired by gas,

oil, or electricity. Also has sections on core ovens, oil burners, and centrifugal blowers. *Stroman Furnace & Engineering Co.*
For Manufacturer's Information Circle No. 71, Page 7-8

Welding alloy wall chart gives recommendations for welding cast iron, aluminum, steel, and other metals. Also contains bonding temperatures, tensile strengths, and hardness. Drawings indicate proper joint designs. *Eutectic Welding Alloys Corp.*
For Manufacturer's Information Circle No. 72, Page 7-8

Shell molding applications and case histories are featured in news bulletin showing how process replaced competitive methods. *Durez Plastics Div., Hooker Electrochemical Co.*
For Manufacturer's Information Circle No. 73, Page 7-8

Gas-shielded welding process using CO_2 and consumable-electrodes is discussed in 4-p bulletin. Gives applications, specifications, and illustrations of automatic welding equipment for ferrous and non-ferrous alloys. *General Electric Co.*
For Manufacturer's Information Circle No. 74, Page 7-8

Job evaluation, its determination and administration are explained in 14-p booklet which discusses the role of union participation, job analysis, and the rating process. *Business Research Corp.*
For Manufacturer's Information Circle No. 75, Page 7-8

Magnesium casting alloys bulletin, 40 pp, details four alloy groups now being cast including new Mg-Th-Zr alloys. Eighteen tables and 15 charts give physical and mechanical properties and elevated temperature characteristics. *Dow Chemical Co.*
For Manufacturer's Information Circle No. 76, Page 7-8

Noise control brochure illustrates with charts and photographs the applications of pneumatic mufflers to control exhaust noises on air-operated equipment. Charts give data on frequency and attenuation levels. *Allied Witan Co.*
For Manufacturer's Information Circle No. 77, Page 7-8

Chromium-silicon-manganese alloy for improving gray cast iron is explained in 6-p bulletin. Gives composition, purpose, application, and benefits derived from its use. Charts illustrates the final properties. *Vanadium Corp. of America.*
For Manufacturer's Information Circle No. 78, Page 7-8

Technical service bulletin discusses correcting porous liner castings in aluminum-magnesium alloy; how design is affected by foundry practice;

standard specifications of copper-tin alloys, bronzes and red brasses; pressure and exothermic feeding of iron castings. *Foundry Services, Inc.*
For Manufacturer's Information
Circle No. 79, Page 7-8

Conveyor belt repairing service bulletin outlines facilities and procedures for extending life of belts by repairing on location and rebuilding in shop. *Conveyor Belt Service, Inc.*
For Manufacturer's Information
Circle No. 80, Page 7-8

Induction melting and holding furnace (60 cycle) for continuous supply of molten aluminum is described in 6-p illustrated reprint. *Ajax Engineering Corp.*
For Manufacturer's Information
Circle No. 81, Page 7-8

Research microscope booklet, 20 pp, gives detailed information on 14 models and accessories. *Bausch & Lomb Optical Co.*
For Manufacturer's Information
Circle No. 82, Page 7-8

Sand rammers, pneumatic, 3 sizes, are discussed in 4-p catalog which includes photos and specifications. *Ingersoll-Rand.*
For Manufacturer's Information
Circle No. 83, Page 7-8

Core binder, self-curing, serves as sole binder with dry sand. Four-page technical bulletin gives specifications, applications, advantages, and precautions. *Reichhold Chemicals, Inc.*
For Manufacturer's Information
Circle No. 84, Page 7-8

Mulling machine bulletin, 36 pp, describes line which incorporates centrifugal force applied through horizontally mounted, rubber-tired mulling wheels. Contains dimensioned engineering drawings of numerous installations. *Beardsley & Piper Div., Pettibone Mulliken Corp.*
For Manufacturer's Information
Circle No. 85, Page 7-8

Die casting machine brochure gives specifications on unit producing castings weighing up to 2½ lb. Line includes 14 models. *Cast-Master, Inc.*
For Manufacturer's Information
Circle No. 86, Page 7-8

Plastic steel combination for use in repairing castings and making molds is explained in 4-p bulletin including directions for use. Said to possess high strength at temperatures as high as 400 F. *Chemical Development Corp.*
For Manufacturer's Information
Circle No. 87, Page 7-8

Radial grinder bulletin, 8 pp, includes pictures, specifications and operating data on self-contained and suspended models for grinding and snagging steel and iron castings. Wheel diameters range from 8 to 24

in., surface speeds from 1572 to 2625 rpm for high speed wheels. *Mummert-Dixon Co.*
For Manufacturer's Information Circle No. 88, Page 7-8

Instrumentation bulletin provides information on operation and uses for pH meter, reflectance unit, gas chromatography, spectrophotometer, and other devices in 12-p illustrated equipment listing. *Scientific Instruments Div., Beckman Instruments, Inc.*
For Manufacturer's Information Circle No. 89, Page 7-8

Refractory surface seal data sheet lists applications and details on composition and storage. Brushed on firebrick like paint it lengthens life of brickwork. *J. H. France Refractories Co.*
For Manufacturer's Information Circle No. 90, Page 7-8

Zircon core material and mold coating having melting point over 4000 F is outlined in technical bulletin. Coating's white color aids in checking of thickness. *Frederic B. Stevens.*
For Manufacturer's Information Circle No. 91, Page 7-8

free films

Ductile Cast Iron, 16 mm motion picture, sound, color, 16 min running time. *International Nickel Co.*
Circle No. 92, Page 7-8

CO_2 Process in the Foundry, 16 mm motion picture, black and white, sound, 20 min running time. *Delhi Foundry Sand Co.*
Circle No. 93, Page 7-8

Casting Design as Influenced by Foundry Practice, 35 mm filmstrip, 52 frames, 12-in. 33-1/3 rpm long-playing record, 30 min running time. *Meehanite Metal Corp.*
Circle No. 94, Page 7-8

A Career in Metal, 35 mm filmstrip, color, 55 frames, 30 min running time. Suitable for showing to high schools, service clubs, and vocational counselors. Narration with musical background on one 33-1/3 rpm recording. Produced under sponsorship of AFS Northwestern Pennsylvania Chapter. *American Foundrymen's Society.*
Circle No. 95, Page 7-8

How to Select the Right Grinding Wheel, 16 mm motion picture, sound, color, 30 min running time. Explains wheel markings and how to determine wheel for specific application. *Norton Co.*
Circle No. 96, Page 7-8

Can MECHANIZATION Solve the Coming MANPOWER SHORTAGE?

J. S. McCauley /
U. S. Dept. of Labor, Washington, D. C.

Only if more engineers and technicians can be attracted to the foundry industry

Marked changes are taking place in the pattern of skills needed to successfully operate jobbing foundries in this country. As indicated in data collected by the U. S. Department of Labor, castings producers will hire six per cent more employees during the period 1957-1960. *However*, most of this increase will come from additional employment of *engineers* and *technicians.*

The chart on the cover of this issue graphically demonstrates this trend. The number of engineers in jobbing foundries is expected to increase by over 30 per cent. Demand for technicians in the industry is a close second with a growth of almost 20 per cent expected by 1960. Only a slight increase in the number of foremen required in this same period my reflect a shift of functions from foremen to engineers.

This trend has been taking shape during the period 1950-1957, as indicated by Fig. 1 on this page. The demand for engineers and technicians far exceeded that of any other occupational group in the industry. In comparison with these past years, future needs are moving at a rapidly accelerating pace. The need for the Foundry Educational Foundation and the AFS Training Institute becomes remarkably apparent if the supply of trained men is expected to equal these future needs.

The impact of new foundry processes and mechanization becomes apparent in Fig. 2. Demand for maintenance mechanics will become abnormal in the near future because more and more foundries are solving their production problems with mechanization. Conveyor systems, fork lift trucks, and molding machines increase worker productivity but these devices require skilled attention by mechanics and electricians.

Increased demand for coremakers reflect the value of the new coremaking techniques such as core blowing, core shooting, shell cores, CO_2 cores, dielectric cores, and cold-set cores. Better cores lead to elimination of expensive machining and cleaning operations, making castings more competitive with other fabrication processes.

The trend toward the increased use of machinery in jobbing foundries is graphically displayed in one of the bar charts on the cover. The left-hand segment of these bars indicate the per cent of foundries reporting definite plans for installing additional machinery or equipment by 1960. The center bar segment shows the per cent "undecided." Right-hand portion represents those with no plans to install additional machinery. About 55 per cent of the foundries reporting in this survey have definite plans for installing additional machinery or equipment by 1960. Gray iron and steel foundries lead in this trend. Less than one half of the workers included in the study were engaged in operating machinery.

The Department of Labor survey showed that foundry workers were, on the average, older than workers throughout all non-agricultural industry. This significant situation is summarized in Fig. 3. Over 26 per cent of the patternmakers are over 55 years of age. Of these, 17 per cent are over 60. The heavy concentration of older workers in the foundry industry indicates the need for an extensive training program to provide replacements for losses due to retirement and death.

The training period required for various occupations in the foundry industry are portrayed in Fig. 4. A serious problem confronts the industry when it is realized that over 48 months are needed to train the new patternmakers soon to be required in this "over-age" group. Similarly, with the need for hand coremakers exceeding any other occupation classification in jobbing foundries, training periods range from two to four years. In January, 1957, foundries included in this study had only 480 workers engaged in training programs. Immediate action in expanded training programs is certainly indicated.

For a closer look at the distribution of employment, by occupation and type of foundry in January 1957, Table 1 has been prepared. In studying this table certain observations are worth noting. Steel foundries employ a markedly higher percentage of mantenance mechanics, chippers, and welders than the other foundry groups. This reflects the high degree of mechanization reached by the steel foundries and the inability of refractory molding materials to resist the high pouring temperatures of steel.

Gray iron foundries use more firs tclass molders and core makers while malleable foundries are far ahead of the others in the employment of machine molders. Mass production of malleable iron parts probably accounts for this latter situation.

This survey of skill requirements and training needs in semi-production, specialty, and job foundries was conducted in January 1957 by the U. S. Department of Labor, in cooperation with a committee representing the various branches of the foundry industry. The committee assisted in the preparation of the report.

Foundry associations reviewed the questionnaire and selected a representative group of foundries

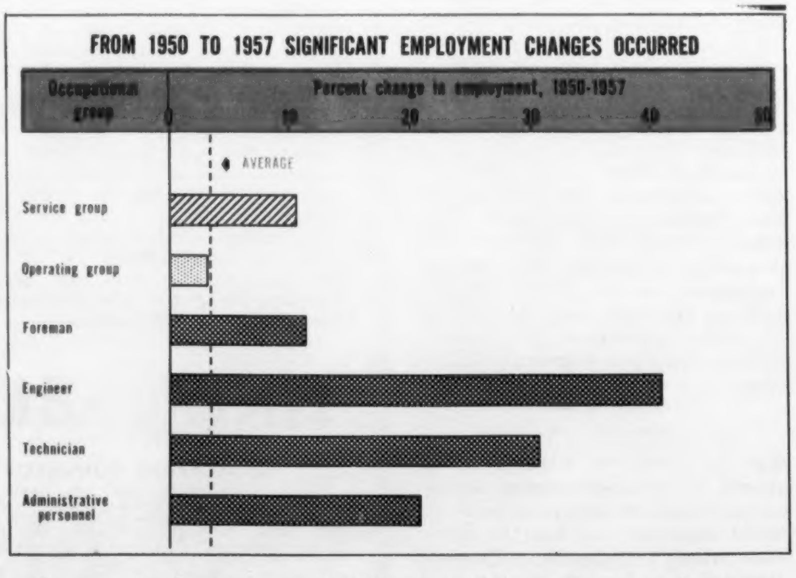


Fig. 1 . . Mechanization has increased need for engineers, technicians.

TABLE 1. DISTRIBUTION OF EMPLOYMENT, BY OCCUPATION AND TYPE OF FOUNDRY, JANUARY 1957

Occupation or occupation group	Total	Gray iron	Malleable iron	Steel	Nonferrous
			Number		
Total	16,829	7,767	3,281	3,182	2,599
			Percent		
Total	100.0	100.0	100.0	100.0	100.0
Selected service occupations:					
Electrician, maintenance	.6	.5	.8	1.0	.5
Mechanic, maintenance	2.3	2.1	1.9	3.8	1.5
Millwright	.5	.7	.6	.2	.1
Pattern storage man	.8	.8	.4	1.1	.6
Patternmaker	1.6	1.4	1.9	1.3	2.1
Selected operating occupations:					
Chipper	5.4	5.2	2.6	9.4	4.5
Coremaker, hand					
1st class	3.7	5.3	1.1	2.6	3.4
2nd class	.7	.6	.4	.5	1.4
Coremaker, machine	2.1	2.3	2.3	1.0	2.7
Craneman	2.1	2.4	.2	4.2	.7
Grinder	5.6	4.8	6.4	5.3	7.0
Ladleman	2.6	2.9	2.7	1.7	2.7
Melter	2.0	1.8	1.4	1.3	4.0
Molder, hand, bench					
1st class	1.5	1.5	.9	.9	2.8
2nd class	.2	.3	*	.1	.4
Molder, floor					
1st class	3.7	5.6	.3	3.0	3.3
2nd class	.8	.7	.1	2.1	.3
Molder, machine	9.0	8.4	15.3	4.8	7.3
Sand preparer	2.3	3.3	1.0	1.9	1.9
Shake out man	4.5	4.3	5.1	3.8	5.3
Welder:					
1st class	1.2	.9	.1	3.9	.3
2nd class	.3	.2	.3	.6	.3
Other operating and service occupations	27.0	25.0	37.0	25.5	21.9
Trainees:					
Coremaker	.4	.6	.1	.1	.5
Molder	1.8	3.4	.7	.2	.6
Patternmaker	.2	.2	.4	.1	.2
Other trainees	.4	.7	.1	.1	.1
Technicians:					
Chemist assistant	.2	.2	.2	.4	.2
Metallurgist assistant	.3	.3	.4	.2	.2
Sand technologist	.1	.1	.3	.2	*
Other	.4	.2	.5	.7	.8
Foreman (non-working)	4.5	4.5	5.1	5.1	3.5
Engineer, metallurgist, and other professional technical personnel	.8	.8	.8	.9	.8
Administrative and other management personnel, including office workers	10.4	8.0	8.6	12.0	18.1

*Less than 0.05 percent

from each branch of the industry. Field representatives of the Bureau of Apprenticeship and Training and State Apprenticeship Agencies visited each of these foundries to obtain the required information. This study is based upon statistical data provided by officials of 101 foundries.

The foundries included in the study represent about 5 per cent of the total employment in the nation's independent foundries. In terms of tons of castings produced, the surveyed plants represent a somewhat smaller proportion of the foundry industry.

Members of the Foundry Advisory Committee were: Chairman Fred G. Sefing, International Nickel Co., New York, C. R. Culling, Carondelet Foundry Co., St. Louis, Roy A. Gezelius, General Steel Castings Corp., Eddystone, Pa., Harry D. Horton, Ingersoll-Rand Co., Phillipsburg, N. J., Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, Ohio, A. B. Sinnett, American Foundrymen's Society, Des Plaines, Ill., and F. G. Steinebach, Penton Publishing Co., Cleveland.

Fig. 2

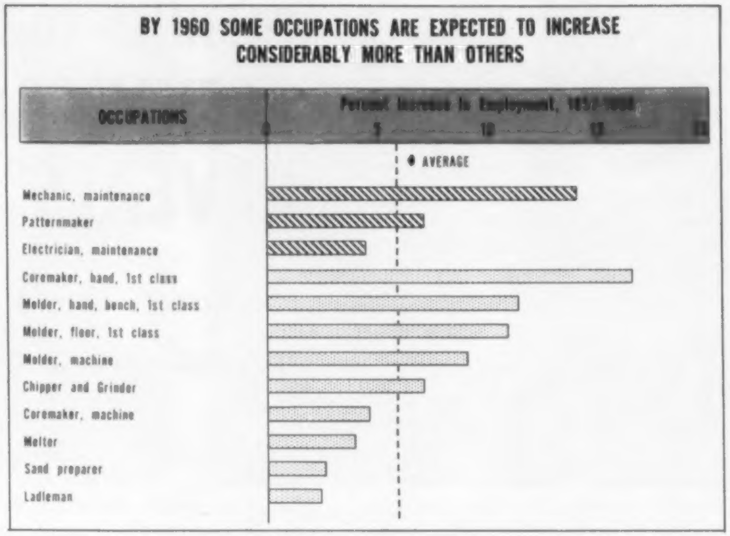


Fig. 3

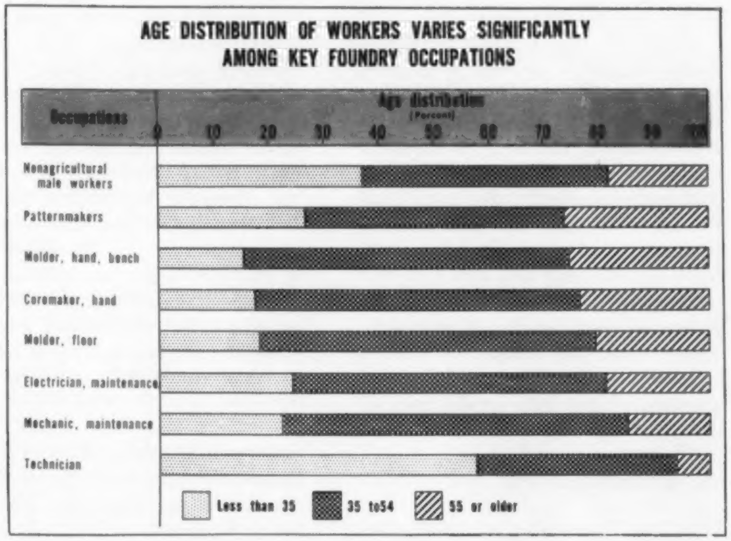
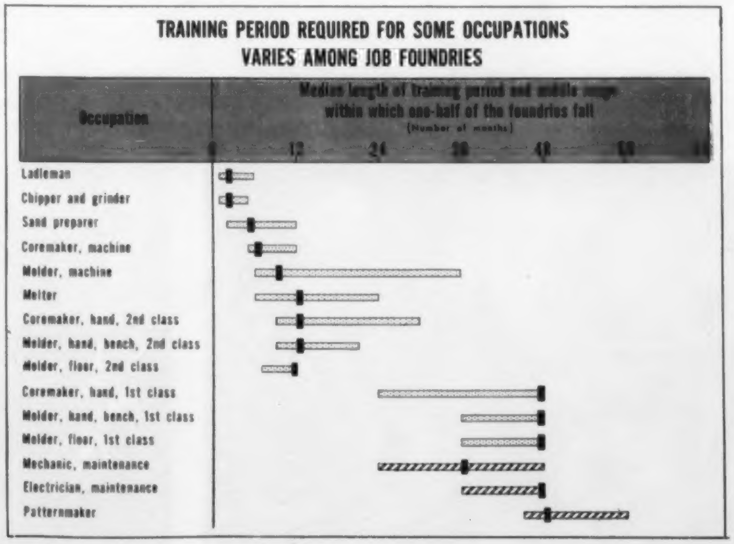


Fig. 4



CASTINGS CONGRESS NEWS STORY—PART 2

TECHNICAL PROGRAM REVEALS ADVANCING TECHNOLOGY

Research leads way for foundries to improve quality and production of casting industry

Technology in the metal castings industry is advancing rapidly and in many separate areas —this was the report from the 61st Castings Congress of the American Foundrymen's Society.

On these pages MODERN CASTINGS completes its report summarizing each of the papers presented at the 50 technical sessions of the congress. Other papers were reported on in the June issue.

Sand

New Techniques for Finding "Come and Go" Causes that Affect Quality, E. C. Zuppann, Oliver Corp., South Bend, Ind. Because of the many variables involved in foundry production that can contribute to scrap castings, the speaker suggested daily tabulation of scrap according to cause.

Some of the factors tabulated were: minutes of black colored slag, tests with carbon equivalent over 4.2, times pouring temperature was low, number of off-color cores, and times that sand had low permeability. Collecting such data for 14 to 20 days will indicate the true source of many foundry problems contributing to scrap.

Discussion following the paper indicated that the use of this technique must be tempered with a considerable knowledge of foundry practice. Incorrect application of the method could invalidate the mathematics on which it is based, the questioner stated.

How to Determine Moisture Requirements of Molding Sands, R. W. Heine, University of Wisconsin, Madison, Wis., E. H. King, and J. S. Schumacher, The Hill & Griffith Co., Cincinnati. Realizing that water is an important sand additive meriting careful control, the authors made a thorough study of the water requirements of the various molding sand ingredients.

Water requirements were determined for the various clays, sand grain sizes, and special additives such as sea coal and cereal. The experiments developed relations between water and the other mix ingredients so as to obtain peak strength. With the moisture requirements of the ingredients satisfied by the techniques and data presented in the talk, it is possible to compare widely different sand mixtures.

Steel and Scabbing. Report of AFS Physical Properties of Steel Foundry Sands at Elevated Temperatures Committee (8-L). Presented by E. E. Hucke, University of Michigan, Ann Arbor. Mr. Hucke reported on the progress of the AFS investigation of molding sands for steel castings. This study is now being continued in a production foundry. In the report Mr. Hucke stated that a successful correlation between expansion and deformation characteristics of steel molding sands has been made. He reported that in all but two instances the committee had found it possible to establish a break-point for a given sand which would tend to eliminate the scabbing defect.

Practical Studies of Veining Tendencies, George DiSylvestro, Burnside Steel Foundry Co., Chicago. The speaker used a large number of slides to demonstrate the use of a test casting to evaluate veining tendencies of many different core mixes.

It was found that veining in steel castings was promoted by increased gas evolution, variations in raw materials, coarser sand, insufficient venting or baking, and silica flour additions. Veining tendencies were reduced by quality control of raw materials, and the use of finer sand, iron oxide, bentonite, fire clay, and core binders with low gas content and rate of evolution.

During the discussion period it was demonstrated with slides that increasing temperature results in an increase in veining. De Sylvestro explained that a liquid resin binder was used in the tests because of its compatibility.

Effect of Various Clays and of Tempering Method on Sand Properties and Casting Quality, A. E. Murton, Dept. of Mines & Technical Surveys, Ottawa, Canada. Mr. Murton described the evaluation of four commercial foundry bonding clays—western and southern bentonite, Ohio fire clay, and Illinois illite.

The speaker stated that in respect to the amount of binder used, ease of molding, and finished casting quality, the western bentonite produced the best results in both the mulled and unmulled conditions. In the unmulled condition the illite was the only clay producing a quickly prepared and easily controlled sand mix.

Mold Hardness: What it Means! R. W. Heine, University of Wisconsin, Madison, E. H. King and J. S. Schumacher, The Hill & Griffith Co., Cincinnati. Since mold hardness is a rapid and relatively simple test to make, the authors studied its relation to other properties.

From their work it appeared that mold hardness is basically a measure of the amount of bonding (strength) available. In clay-satu-

Chairman of gray iron shop course, D. E. Matthieu, left, congratulates speaker D. E. Krause. W. W. Holden is at right.

Speaking at evening sand shop course is J. B. Caine. Others on panel from left are Moderator L. J. Pedicini, M. H. Horton, G. F. Watson, R. E. Daine, F. B. Rote.

rated molding sands there is a basic relationship between mold hardness and green strength. In clay-poor sands the relationship depends on clay content and factors influencing its distribution.

The speaker cited practical applications for this information by developing mold hardness curves for a molding sand in a shop. The foreman can tell immediately the physical properties of the sand at any time with a simple hardness test.

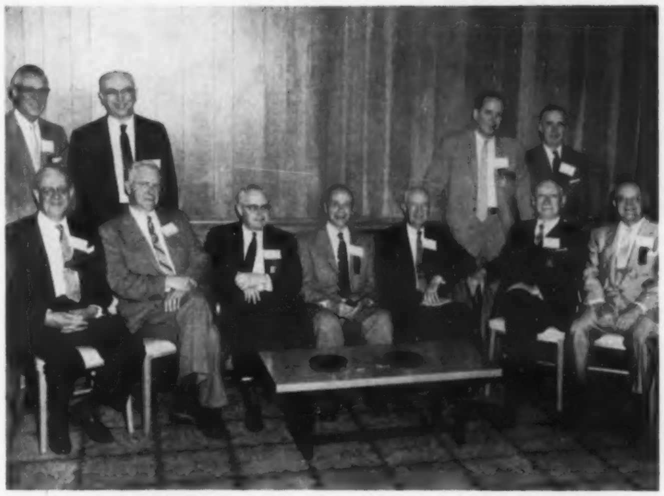
Influence of Sand Grain Distribution on Green-Sand Casting Finish, C. E. McQuiston, Advance Foundry Co., Dayton, Ohio. Increasing demand on the part of customers for castings with good "as-cast" surface finish led Mr. McQuiston to study the effects of foundry variables on this casting property.

Statistical analysis of data derived in these experiments led the speaker to conclude that the mean sand grain diameter is the most important factor contributing to casting roughness. The spread of grain sizes has a lesser influence as does the squeeze pressure in molding.

European Self-Curing Oil Binders, Franz Moser, Oel- & Chemie Werk A. G., Hausen b/Brugg, Switzerland. Auto-hardening core binders are prepared from a drying oil, characterized by the preponderance of conjugated double bonds. To this is added an accelerator containing a peroxide group. The two are mixed with sand in conventional sand mixing equipment and poured into core boxes. Practically no ramming is required.

Some of the advantages of this process for making cores are: (1) ease of filling complex core boxes, (2) reduced labor due to reduction in ramming time, (3) sand economy through use of coke in center of core with wall thickness of only a few inches, (4) reduction in number of core rods used, and (5) improved dimensional accuracy.

Properties of Molding Sands Under Conditions of Gradient Heating, N. C. Howells, and R. E. Morey, Naval Research Laboratory, Washington, D. C., and H. F. Bishop, Exomet Corp., Conneaut, Ohio. In order to conduct this research program the authors had to design and build an apparatus for compression testing a sand specimen while it was exposed to thermal gradients simulating solidifying metal.



Past Presidents attending the AFS Alumni dinner were, back row, F. J. Dost, Alumni Secretary S. C. Massari, B. L. Simpson, and I. R. Wagner. Front row, left to right; Walter Seelbach, E. W. Horlebein, F. J. Walls, R. J. Teetor, W. R. Bean, G. H. Clamer, Hyman Bornstein.

Californians congratulate retiring president F. W. Shipley. Left to right are incoming director John Russo; Robert Gregg; retiring director B. G. Emmett. Subject may have concerned basic heat transfer equations.

The apparatus utilized a cobalt pedestal heated by an induction coil. A conventional sand compression specimen was placed on the pedestal and subjected to a compression load. Pedestal temperature, time of specimen contact and sand mixture were varied to obtain compression strength data.

As a result of these tests the investigators found a correlation between hot tearing in steel castings and dry density of cores. To avoid hot tearing sand cores must be compressible under the contraction stresses of a solidifying casting. This property was attained by adding ammonium nitrate to the sand, causing sand to become mushy and flowable under the influence of casting heat.

Influence of Various Bonding Materials on Stress-Strain Characteristics of Bonded Sands, F. Quigley and P. J. Ahearn, Rodman Laboratory, Watertown Arsenal, Watertown, Mass., and J. F. Wallace, Case Institute of Technology, Cleveland. The speaker described the tensile, compression, and transverse bend testing of sand bonded with the following agents: western bentonite, core oil, thermal setting resin, and sodium silicate.

Electric strain gages were used to measure strain during loading. As a result of the investigation the authors found that for cured or baked sand specimens bonded with sodium silicate, resin or core oil the modulus of elasticity in both compression and tension was approximately 7 x 10^5 psi at room temperature. The bonded sands were both elastic and brittle with little evidence of plastic, viscous or non-uniform behavior under stress at room temperature.

Oil Bonded Molding Sand, K. A. Mierické and R. C. Megaw, Baroid Div., National Lead Co., Chicago. In this talk the speaker pointed out inherent disadvantages arising from water contained in

Ladies boarding the boat for a scenic trip Thursday down the Ohio river, one of the features of the ladies program. Other events included the official tea Monday and a noon luncheon and fashion show held on Tuesday.

Cincinnati wives officiating at the Ladies program: Mrs. C. T. Koehler, Mrs. M. E. Rollman, Mrs. R. J. Westendorf, Mrs. M. E. Johnson, Mrs. R. S. Thompson, Mrs. E. H. King.

Casting design and production were discussed at gray iron luncheon by G. W. Schuller, Jr., center. Presiding were H. W. Lownie, left, and C. K. Donoho, one of the recipients of the AFS Gold Medal award.

molding sands. Sound castings with improved surface finish resulted from the development of waterless sand mixes utilizing a bentone adhesive and oil as the bonding agent.

The Effect of Temperature on the pH of Foundry Sands, N. D. Brinkmann, Process Development Section, GMC, Detroit, and Gordon Gottschalk, Thiem Products, Inc., Milwaukee. The work described by the authors of this paper was prompted by the observation that sand from cores remaining in castings during annealing at 1700 F could not be reused in coremaking. Investigation proved that this burned sand had a pH of 11.

With this strong basicity, baked cores could not be made with acceptable physical properties. The change in pH was attributed to calcium carbide in the sand being converted to calcium oxide by heat. This undesirable rise in pH begins when sand is heated above 1500 F. Sensitivity of sand properties to pH make it a good indicator to warn of impending trouble developing in sand mixes.

Gray iron's largest session featured eight papers. Participants, front row, C. C. Reynolds, W. C. Jeffery, C. F. Walton, J. S. Vanick. In rear, Walter Edens, J. F. Wallace, Sidney Low, S. T. Walter.

Correlation Between Casting Surface and Hot Properties of Molding Sands, AFS Sand Division Committee on Physical Properties of Iron Molding Materials at Elevated Temperatures. Culminating a series of studies devoted to casting defects attributable to elevated temperature properties of sands, the committee reported the development of a simple laboratory test to measure significant sand properties.

As a result of this work the committee developed two simple one-specimen tests to measure scabbing, buckling, and rat-tailing tendencies of molding sands for iron castings. One test, shock expansion, measures tendencies toward mold wall expansion failure. The second was a load restraining test at 1800 F, at 5 minute soak.

Additions of cushioning materials such as sea coal, pitch, cellulose materials, cereal binders, and clays, were said to reduce tendency to mold wall expansion failures. Reduction of fines in the sand mix are also beneficial.

Sand Division Dinner

Controlling Quality on the Chevrolet Cylinder Block Casting, W. C. Schartow, Chevrolet-Saginaw Grey Iron Foundry Div., General Motors Corp., Saginaw, Mich. With the aid of a motion picture, Mr. Schartow described the production of the Chevrolet V-8 engine block casting. He described the production line as having its beginning with special equipment which obtains foundry sand by sucking sand from the bottom of Saginaw Bay at the rate of 1200 tons in 1½ hours. Sand and water is emptied into a boat and is delivered to a rail car at the dock. It is then transported to the foundry where the sand is dried and mixed. Coremaking and assembling is extensively mechanized and conveyorized. Checking fixtures are used to hold tolerances to minimum levels. Special equipment has been designed to handle casting and shakeout.

Fundamental Papers

Fluidity of a Series of Magnesium Alloys, J. E. Niesse, M. C. Flemings, and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass. In order to measure fluidity, the authors used a steel tube, flushed with SO_2, dipped into crucible of molten metal, valve opened to vacuum pump, and metal sucked into tube. The distance the metal flowed into the tube was a measure of its fluidity.

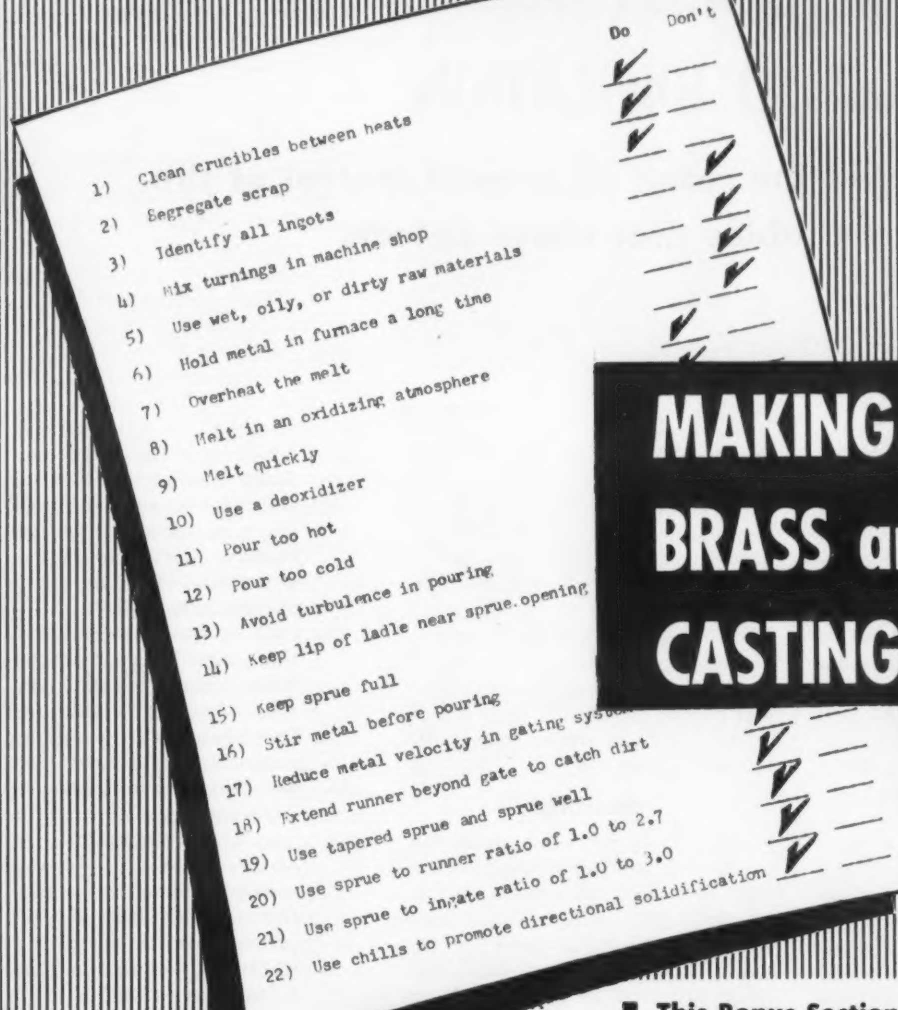
In the presentation of the paper it was brought out that: (1) Fluidity dropped when small amounts of alloying elements were added, (2) fluidity improved as composition approached eutectic, and (3) in general, fluidity varied inversely as the freezing range or temperature difference between the liquidus and solidus.

Questions asked of author Niesse at the end of his presentation included the following: are the tests reproducible, and why are glass tubes used in the test? Mr. Niesse answered by describing the successful reproduction of results obtained with the test.

The Fluidity of Some Aluminum Alloys, S. Floreen and D. V. Ragone, University of Michigan, Ann Arbor. According to the speaker the fluidity of a series of Al-Cu and Al-Mg alloys were determined. Samples were drawn into a glass tube using a regulated vacuum system. The length of metal drawn into the tube was used as a measure of fluidity.

As the result of these measurements it was concluded that the fluidity of these alloys varies inversely with their solidification range. This variation in fluidity is more closely related to a non-equilibrium solidification range than to the range indicated on equilibrium diagram.

Influence of Vibration on Solidifying Metals, A. H. Freedman and J. F. Wallace, Case Institute of Technology, Cleveland. The authors described how they vibrated various aluminum-base and copper-


Do Don't

1) Clean crucibles between heats
2) Segregate scrap
3) Identify all ingots
4) Mix turnings in machine shop
5) Use wet, oily, or dirty raw materials
6) Hold metal in furnace a long time
7) Overheat the melt
8) Melt in an oxidizing atmosphere
9) Melt quickly
10) Use a deoxidizer
11) Pour too hot
12) Pour too cold
13) Avoid turbulence in pouring
14) Keep lip of ladle near sprue.opening
15) Keep sprue full
16) Stir metal before pouring
17) Reduce metal velocity in gating system
18) Extend runner beyond gate to catch dirt
19) Use tapered sprue and sprue well
20) Use sprue to runner ratio of 1.0 to 2.7
21) Use sprue to ingate ratio of 1.0 to 3.0
22) Use chills to promote directional solidification

MAKING QUALITY BRASS and BRONZE CASTINGS

A MODERN CASTINGS —BONUS—

This report is the 24th in a monthly series presented by MODERN CASTINGS to analyze vital problems in the industry. A limited number have been reprinted and are available for 50 cents each.

■ **This Bonus Section is based on information gathered by the members of the 1955-56 Shop Course Subcommittee of the AFS Brass & Bronze Division for presentation at the 1956 Castings Congress.**

R. A. Colton and F. L. Riddell compiled the information, but basic material was furnished by the following members of the committee: R. B. Fischer, committee chairman, Ingersoll-Rand Co., Phillipsburg, N. J.; E. F. Tibbetts, Wollaston Brass & Aluminum Foundry, Inc., North Quincy, Mass.; D. E. Best, Bethlehem Steel Co., Bethlehem, Pa.; R. H. Dawe, Bridesburg Foundry Co., Fullerton, Pa.; R. C. Fischer, Casting Co., Dunellen, N. J.; T. E. Gregory, Michigan Smelting & Refining Div., Bohn Aluminum & Brass Corp., Detroit, Mich.; C. E. Muller, Ingersoll-Rand Co., Phillipsburg, N. J.

DEFECTS DUE TO MELTING, POURING, and SOLIDIFICATION

Sound castings are the result of proper control of the manufacturing variables that cause defects

Robert A. Colton /
Sales Engineer
Federated Metals Div.
American Smelting & Refining Co.
Newark, N. J.

Making sound salable brass and bronze castings is largely a matter of carefully controlling each step of the foundry process so that the end result is the product of controlled rather than random manufacturing procedure. What is commonly called "good foundry practice" is no more than careful attention to every detail involved in the production of a casting.

When for any reason the foundry practice used in making brass or bronze castings is not as carefully controlled as it should be, any one of a great number of variables can affect the quality of the casting. Foundry defects are usually caused by deviating from either the established practice or following an incorrect practice. Usually foundry defects do not happen but are caused.

Before discussing some of the specific difficulties experienced in the melting and pouring operations, a few comments on the general subject of casting defects would be appropriate. The ability to recognize properly a defect in a casting and to know which of the many manufacturing variables caused the defect is as important to the foundryman as is the ability of the medical doctor or surgeon to properly diagnose illness.

To be a good foundryman requires an objective approach to the problem of dealing with troubles. It means waiting until *all* the facts are available and then carefully assessing the defect for cause, and for treatment. Once the nature of the defect is established the cure may be relatively simple.

Only those factors contributing to the trouble should be changed, and then only one at a time until the condition under study responds favorably. A cautious, studied approach to the problem of defective castings will pay dividends in promptly getting to the heart of the trouble, and over the long run, in helping establish better overall foundry practice and control. The first part of this Bonus Section will relate to defects arising from melting and pouring.

Melting

■ Because of the widespread use of crucible melting in copper-base alloy founding, the remarks to follow are based on that method. The general principles involved are the same whether gas or oil-fired crucibles are used, or any other type of equipment including electric.

Charging the Crucible

Consider first the operation of charging the crucible and the potential for trouble existing at this early stage of the casting process. Contamination at this point can reduce otherwise well made castings to scrap. Some of the possible sources of trouble are:

(A) Using a dirty crucible where skulls or metal films from the previous heat are left on the bottom or on the side walls so the next melt is contaminated by the previous melt. Examples of this would be melting high-grade tin bronzes, or aluminum bronze, or manganese bronze after melting lead-containing bronze; or, melting silicon bronzes and leaded bronzes in sequence. Small amounts of lead can seriously injure any of the above named alloys. In some cases a small lead pick-up will throw the alloy out of specification.

(B) Lack of care in segregating the return scrap is another prime source of alloy contamination. This frequent troublemaker in jobbing foundries requires diligent attention to avoid throwing the wrong gate into the furnace at the wrong time. Use of a color code, a marker system—some means of *positive* identification of *each* piece of home scrap is a must in a well-run foundry.

(C) Adding the wrong ingot to a charge or using scrap of unknown origin. Keeping ingot in marked containers or use of a color code on ingot stock will help avoid mixing of ingots. Refusing to handle any unidentified scrap is the safest way to avoid the great risk attendant to melting down castings or other material of unknown origin.

(D) Allowing turnings to become mixed in the machine shop and then charging them back in the furnace. Better housekeeping is always essential to avoid contamination from this source of trouble.

(E) Introducing gas-forming materials into the metal either by charging wet, oily, or dirty materials, or by

careless additions to the molten metal should be avoided. Since even moisture on ingots or scrap can cause trouble, diligence in charging only *clean* materials into the crucible is essential.

Contamination Defects

The presence of contamination can be manifested in a number of ways.

(A) Casting surface may be marred:
Silicon bronzes picking up lead (or vice versa) may exhibit badly pitted or scaly casting surface—at best usable but no endorsement of the skill of the foundryman making the casting.

(B) Excessive or harmful shrinkage can occur:
In Fig. 1 the effect of a small amount of aluminum on the shrinkage of 85-5-5-5 alloy is shown. Finding a "pipe" in the sprue, or large shrink holes in a job previously run successfully in this alloy may indicate pickup of small amounts of aluminum—an understandable possibility in a shop casting both copper and aluminum alloys. Other examples of what small amounts of impurities or contaminants can do to the normal shrinkage of red brass are also shown in Fig. 1.

(C) Dross or oxides may be trapped throughout the casting:
If the contaminant forms a strong oxide film, such as aluminum or silicon, the oxide so formed may be dispersed throughout the casting in the manner shown in Fig. 2. The unmachined casting shows little of the condition existing throughout the matrix.

(D) Mechanical properties are affected:
Small amounts of contaminating impurities have drastic effects on the mechanical properties of some copper-base alloys. In Tables 1 and 2 test bar data are listed for two alloys containing small amounts of contamination. The powerful effect of small amounts of foreign elements on the mechanical properties of an alloy can reduce the usefulness of a casting, especially where the casting is severely stressed in service.

The presence of deleterious impurities may be noticed in the foundry even if test bars are not broken. Occasionally a machine shop will complain about the "hard" metal in a new batch of castings, or more dramatically, castings break up during handling in the foundry. Both phenomena could be evidence of contamination that

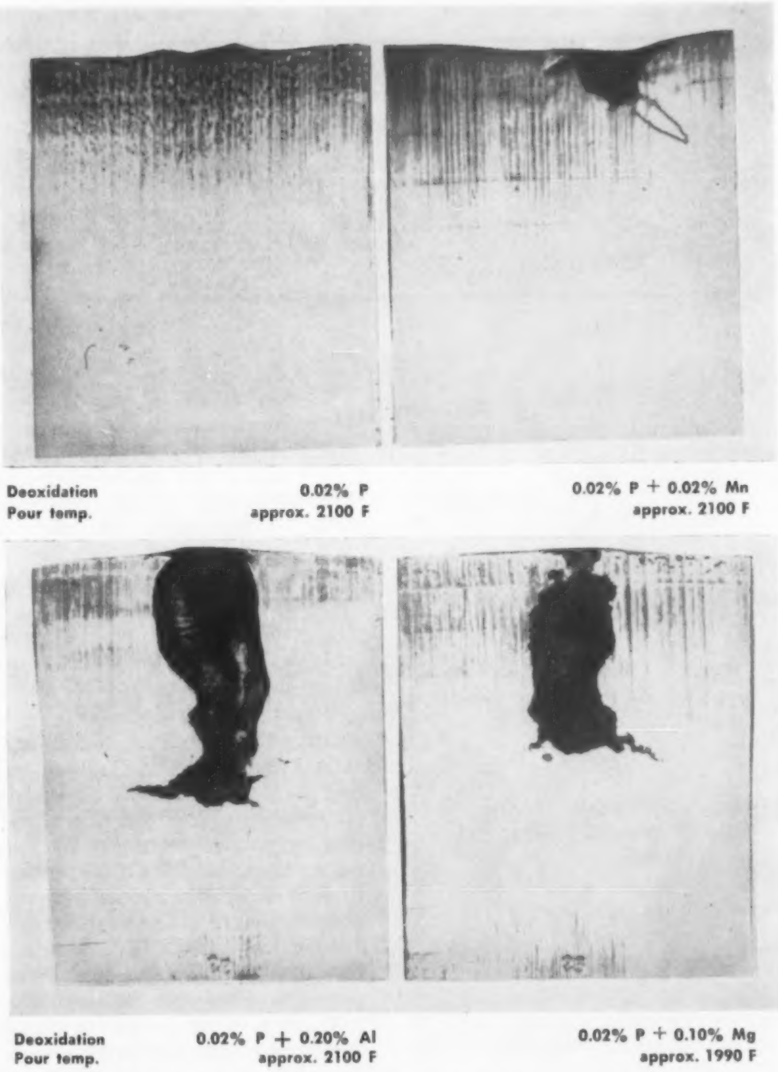


Fig. 1 . . Shrinkage test. Sample: 4 in. diam, 10 in. high; top gated; alloy 85 Cu - 5 Sn - 5 Pb - 5 Zn; melting unit, indirect arc; mold material, oil-bonded zircon sand, mold coating, graphite wash.

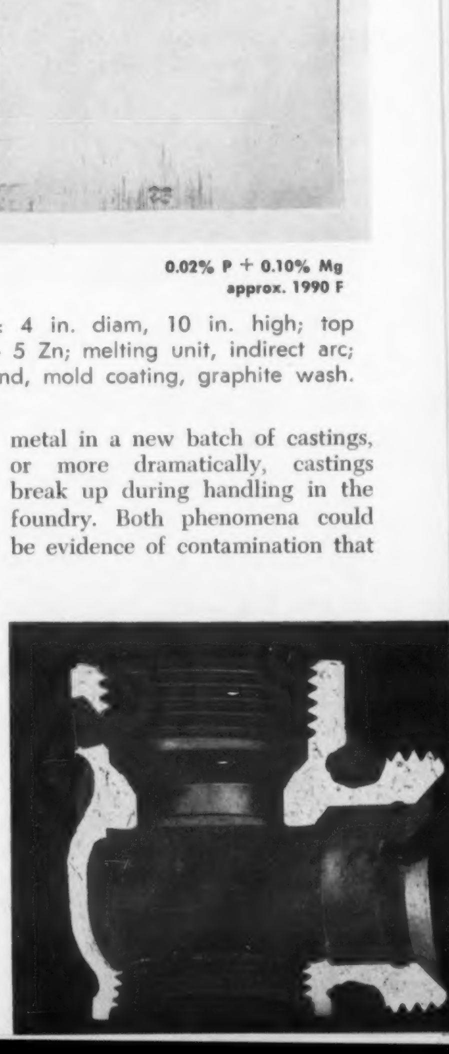


Fig. 2 . . Polished section shows trapped aluminum oxide films that caused this casting to be defective.

TABLE 1. EFFECTS OF ALUMINUM AND SILICON ON TENSILE STRENGTH AND ELONGATION OF COMMERCIAL 80 Cu—10 Sn—10 Pb

Copper %	Silicon %	Aluminum %	Tensile psi	Elongation % in 2 in.
80.14	—		37,500	22.0
79.18	0.002		35,500	19.0
80.03	0.005		34,500	16.0
78.38	0.010		32,000	11.0
79.80	0.015		30,000	8.0
79.45		0.005	37,500	20.0
79.53		0.01	36,500	19.5
80.53		0.04	35,000	16.0
79.30		0.14	30,000	6.0

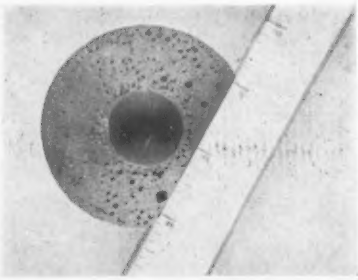


Fig. 3 . . Severe gas porosity in a leaded tin bronze casting.

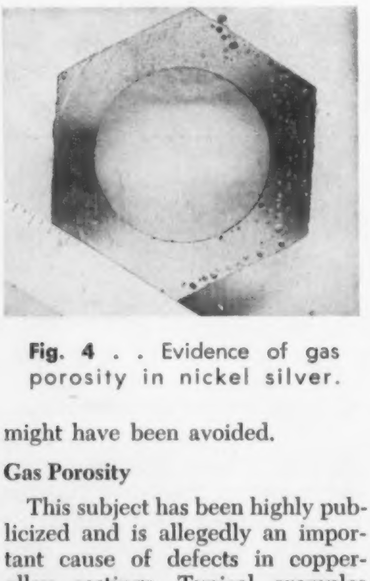


Fig. 4 . . Evidence of gas porosity in nickel silver.

might have been avoided.

Gas Porosity

This subject has been highly publicized and is allegedly an important cause of defects in copper-alloy castings. Typical examples of severe gas porosity are shown in Fig. 3, 4, and 5. These are all presumably cases of gases picked up during the melting operation.

Gases in bronze may be indicated when:

(A) Molten metal in the crucible is excessively lively. Sometimes it is possible to notice bubbles of gas break through the oxide film on the surface.

(B) After pouring the casting the top of riser or sprue puffs up or, in an extreme case, exudes metal. In severe cases of gassed metal, the pressure of the gas may actually drive the liquid metal out of the sprue into the air causing "rain".

(C) A machined or fractured casting exhibits porosity of the type seen in the three examples shown. Gas holes in four common brass alloys are shown in Fig. 6.

Another type of gas in brass and bronze appears as well dispersed, fine gas holes. Perhaps a more serious problem, it is usually found only by pressure testing or fracturing castings. Actually, it is extremely difficult to distinguish between porosity due to gas or to shrinkage, since so-called "interdendritic shrinkage" also consists of well dispersed fine holes in the casting.

There is some reason to doubt that gas porosity ever causes a casting to leak since gas holes are usually not contiguous. More likely, the presence of gas may aggravate the effect of shrinkage—that is, gas may make little holes into larger holes. It is fairly well agreed that a *little gas* may be desirable in the tin bronzes and leaded tin bronzes. Gas can distribute shrinkage more favorably and help avoid leakage that might accompany more concentrated shrinkage. The difficulty lies in knowing what constitutes a "little gas" and how to control it.

Causes of Gas Porosity

The technology of gas in copper-base alloys has been described frequently in the literature. No lengthy discussion is intended here but a few brief explanations of gas sources may be helpful.

Gases in copper-base alloys usually are the result of an unbalanced melting atmosphere. Water vapor is produced when gas and oil burn. The water vapor may react with the molten metal to form hydrogen (H_2), as gas and oxygen (O_2), as metallic oxides. When the metal freezes it tends to give up the gases it absorbed during melting. Gas bubbles form in castings when H_2 comes out of solution or when steam is formed by H_2 and O_2 recombining.

The maximum heating temperature of the metal is important since more gas dissolves with increasing temperature. As the metal temperature falls, solubility decreases and the gas wants to leave the metal. As the metal freezes, most gas is rejected from solution, resulting frequently in casting holes such as shown in Fig. 3 to 6. Because of the affinity of molten brass and bronze for gas absorption at elevated temperatures, allowing molten bronze to stand in the furnace too long—commonly called "stewing"—can be highly detrimental to metal quality.

Fracturing copper-alloy castings is an excellent way to prove the presence of gas holes. If the condition is severe, there is little doubt as to the presence of gas; fine gas holes, however, cannot always be detected by visual inspection because of the difficulty of differentiating between gas holes and shrink holes.

Generally speaking, removal of *all* gas from castings is not desirable. As mentioned previously, gas may alleviate shrinkage problems.

TABLE 2. EFFECT OF SILICON ON TENSILE, YIELD AND ELONGATION OF LOW TENSILE MANGANESE BRONZE

Copper %	Silicon %	Tensile psi	Yield psi	Elongation % in 2 in.
58.23	—	81,000	38,000	20.0
58.70	0.01	77,000	38,700	18.5
58.75	0.09	76,000	36,500	15.5
58.60	0.20	77,000	36,800	11.0
58.40	0.15 (Pb—0.10)	61,100	32,000	4.0

Fig. 5 . . Serious porosity damage in a copper casting.

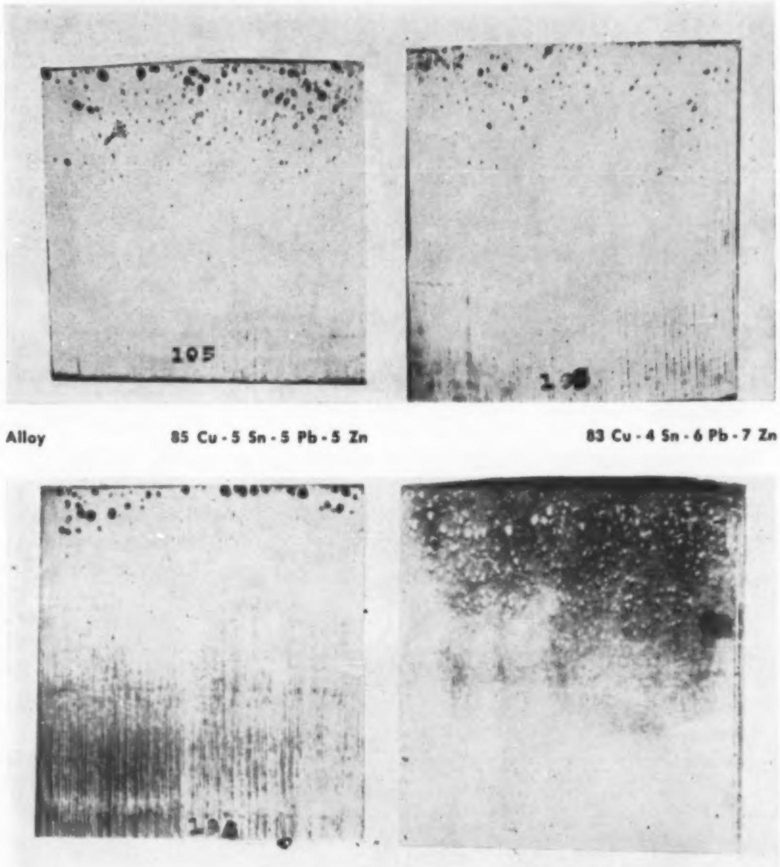


Fig. 6 . . Gas porosity in four common alloys. Sample preparation: melting unit, indirect arc; mold material, oil-bonded silica sand; mold coating, graphite wash; pouring temperature, 2100 F; deoxidation, 0.02 per cent P (0.03 per cent P for low zinc nickel bronze sample.)

If no gas were present, severe, unexpected shrinkage might occur.

Correcting Gas Conditions

To eliminate or reduce the seriousness of gas in bronze improved control of the melting operation is required. Establishing good practices is long range insurance against frequent recurrence of gas problems. Some of these good practices are:

(A) Charge only clean, dry, materials for reasons already described.

(B) Use the so-called "oxidizing" melting technique. Briefly, this means having a slight excess of oxygen in the products of combustion—a matter of completely burning all the fuel. A sharp green flame over the furnace indicates oxidizing conditions (as compared to yellow or smoky flame which shows that some unburned fuel is present in the products of combustion.)

(C) Use a deoxidizer such as phosphor-copper to remove excess oxygen from the metal and thus prevent recombination of the H_2 and the O_2. Fig. 7 demonstrates how phosphor-copper will help eliminate gas in bronze.

(D) Melt quickly; do not overheat the metal or allow it to "stew" in the furnace.

Pouring

■ Fortunately for the non-ferrous foundryman, pouring of copper-base alloy castings is not as difficult as the pouring of light metals. Copper-base alloys are much heavier than air or most of the metal oxides associates with them. This makes separation of liquid metal and oxide or liquid metal and air bubbles take place sufficiently well to avoid trapping either air or oxide in castings. Trapped air bubbles do occur in copper-base alloy castings but rarely from poor pouring practice; a more likely reason would be inadequate venting.

Two aspects of pouring can cause defects in copper-alloy castings.

Effect of Pouring Temperature

The temperature at which brass and bronze alloys are poured greatly affects the quality and soundness of the casting involved.

Castings poured too cold may not feed adequately, castings poured too hot may shrink excessively. The end result may be castings that leak under pressure or exhibit visible shrinkage defects. The correct pouring temperature for each job should be determined experimentally. A calibrated pyrometer or thermocouple should be used regularly in the foundry to measure metal temperatures and the casting poured only within the temperature range known to be satisfactory. Such controlled practice will reduce defects from pouring metal either too hot or too cold.

The effect of pouring temperature is perhaps best demonstrated with a casting produced in quantity under fairly well controlled conditions. Experience has shown that for every casting poured, there is a single pouring temperature where a sound casting can be made regardless of the gating system

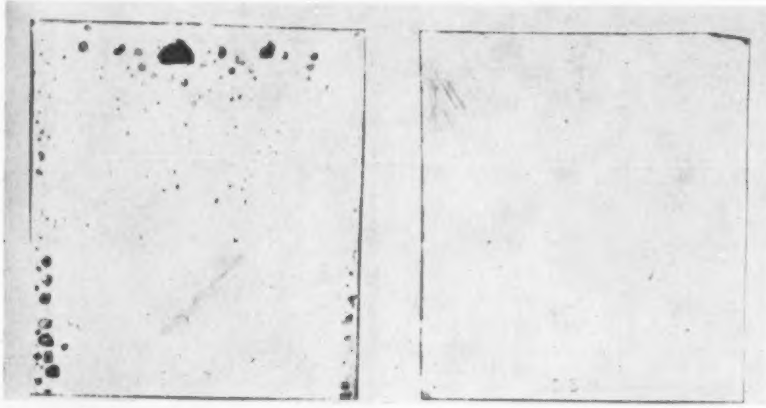


Fig. 7 . . Use of phosphor-copper in bronze casting alloys to eliminate gas porosity. Sample preparation: alloy, 89.5 Cu - 8.5 Sn - 2 Pb; melting unit, indirect arc; mold material, oil-bonded silica sand; mold coating, graphite wash; pouring temperature, 2100 F.

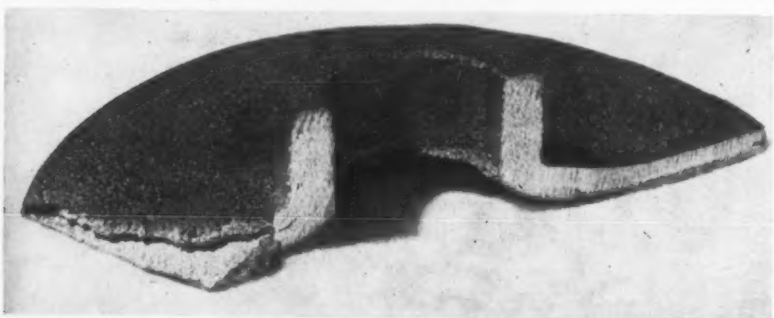


Fig. 8 . . An extreme example of "burn-in" or metal penetration.

used. Finding the exact temperature is both impractical and difficult.

A *range* of temperatures over which an optimum number of molds can be poured is usually determined by trial. As long as castings are poured within the "safe range", minimum scrap will be produced. Castings poured either on the hot or cold side of the range may be unsound for reasons mentioned above.

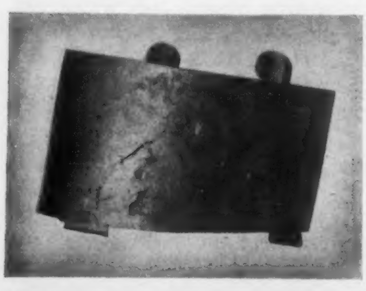


Fig. 9 . . Trapped aluminum oxide in yellow brass casting.

Improper pouring temperature can also affect the surface appearance of castings. If the metal is too hot it may penetrate the sand causing the condition described as "burn-in". Fig. 8 shows an extreme case of penetration in a leaded tin bronze. Metal poured too cold causes laps or seams on casting surfaces. With a minimum of special equipment proper control over pouring temperatures will pay off in improved casting quality.

Effect of Turbulence

Careless pouring of molds is undoubtedly a source of defects in many brass and bronze castings. The principal result of careless pouring is increased turbulence of the metal stream. In the tin bronzes or leaded tin bronzes some damage to castings may result, but the main problem of turbulence comes in handling alloys that are naturally drossy such as yellow brass, aluminum bronze, or manganese bronze. Should the oxide film formed in an alloy be strong and tenacious as is aluminum oxide, a large piece of film may be trapped in the casting so that it gives the appearance of a "cold shut". Such films prevent metal from fusing by mechanically interfering with the flow of the metal stream.

An example of an oxide inclusion defect is shown in Fig. 9. In this case aluminum has been added to yellow brass to improve fluidity but turbulent pouring has caused entrapment of an Al_2O_3 film in the thin casting section. The presence of such inclusions usually indicates turbulence in either pouring or gating.

To reduce pouring defects, the following suggestions will be helpful.

(1) Pour carefully; that is, make every effort to *control* the metal stream and avoid dumping or splashing.

(2) Keep the lip of ladle (or crucible) as close as possible to the sprue opening, This reduces the fall of the metal through air and makes control of the metal stream easier.

(3) Keep the sprue full—either use small diameter sprues (rectangular cross-section sprues are highly desirable)—or chokes at the base of the sprue. Fill the sprue as quickly as possible so as to avoid pulling air and dross down into the casting.

(4) Avoid stirring metal before pouring. Dross and slag may become entrapped in the metal and not completely separate before pouring the castings.

(5) Use pouring boxes wherever possible or, if not feasible, enlarge the top opening of the sprue.

(6) Keep sprues at the edge of the flask so that the ladle does not have to be raised above the mold for the metal stream to reach the sprue (as happens with sprue located in the center of flask).

F. L. Riddell /
Foundry Metallurgist
H. Kramer & Co., Chicago

DEFECTS DUE TO GATING and RISERING

Case histories describe five principal causes of defects due to poor design of gating and risering

The ability to identify and then classify defects in copper-base alloy castings is probably the most important task of the foundryman in holding his foundry losses to a minimum. A single defect can often be attributed to more than one cause. An example is the defect "misrun." A misrun is defined as a casting that lacks completeness, because the mold cavity was not entirely filled with metal. Some of the possible causes for misruns are:

1. **Improper metal conditions**
    a. **Impurities reducing fluidity**
    b. **Improper deoxidation**
    c. **Cold metal**
2. **Interrupted pouring**
3. **Improper gating system**
    a. **Inadequate size gates**
    b. **Turbulent flow of metal**
4. **Sufficient back pressure in mold cavity, caused by improper sand conditions in mold and/or cores, or improper venting of molds so flow of liquid metal to all parts of the mold cavity is prevented.**

Therefore, to correct a defect, all phases of foundry practice must be checked, and the most plausible causes must be corrected.

Some of the defects that can be attributed to poor design of gating and risering systems are:

1) Misrun; 2) Cold shut; 3) Erosion; 4) Turbulence; 5) Shrinkage—due to inadequate riser proportions and design.

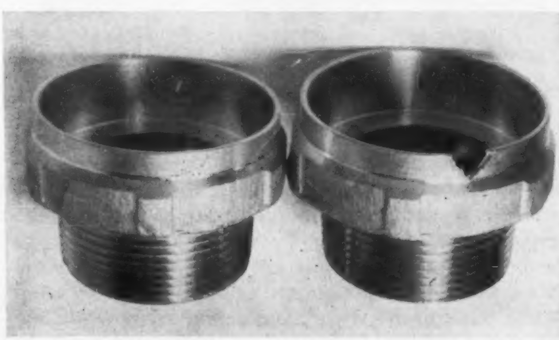
The following case histories will demonstrate how to eliminate casting defects and produce quality castings by using proper gating and risering techniques.

CORRECTING MISRUNS

■ This illustrates a typical red brass plumbing goods casting that has misrun. Probably the first thing to investigate would be the pouring temperature. However, raising the pouring temperature would not completely solve the whole problem. Unsound metal due to *too high* pouring temperature may cause leakage under pressure, after the casting has been machined. Sand and core properties should also be investigated. Excessive gas producing substances in cores or lack of venting in molds may cause sufficient back pressure to prevent liquid metal from completely filling molds.

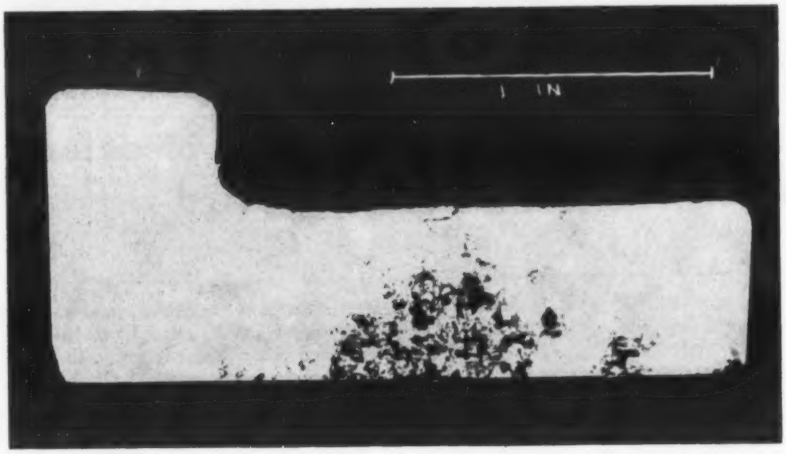
If the sand appears to be satisfactory, then possibly the gating is not of sufficient size to allow the mold cavity to fill before freezing takes place. Since there is usually more than one cavity in the mold and production economies demand that more than one mold be poured from a ladle, pouring must be done over a range of temperatures, rather than at a single temperature. Therefore, gating must be adequate to accommodate a wide range of pouring temperatures.

AVOIDING COLD SHUTS



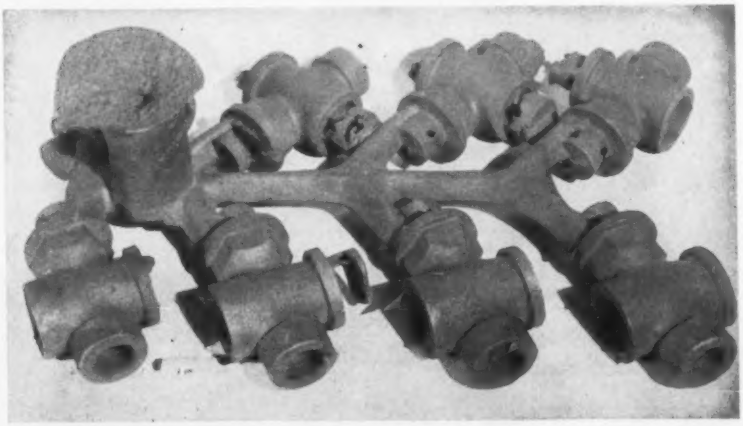
■ This defective red brass casting was due to "cold shuts." There are several possible causes for cold shuts: interrupted pour; cold, sluggish metal; sand conditions, as mentioned for misruns; and a gating system that allows two streams of metal to meet at a temperature where they will not coalesce.

TURBULENCE IN THE GATING SYSTEM



■ These pictures illustrate the effect of turbulence in the gating system of a manganese bronze casting. The stream of molten metal entered the mold cavity in a highly turbulent manner, causing dross to form in the ingate area. Use of a gating system that reduces the velocity of molten metal as it enters the mold cavity will help to prevent the formation of dross. This type of defect is usually encountered only in the aluminum, manganese and silicon bronzes, and the yellow brasses with aluminum added.

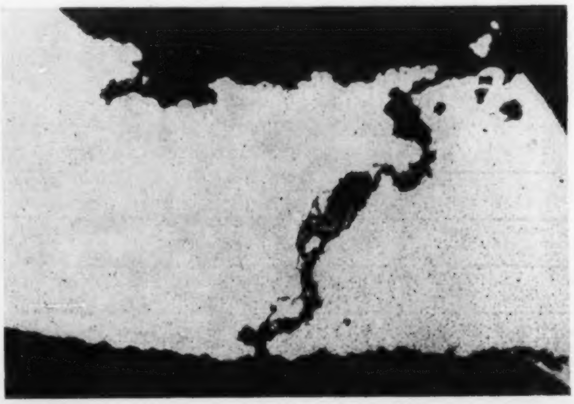
GATING TO PRODUCE CLEAN CASTINGS



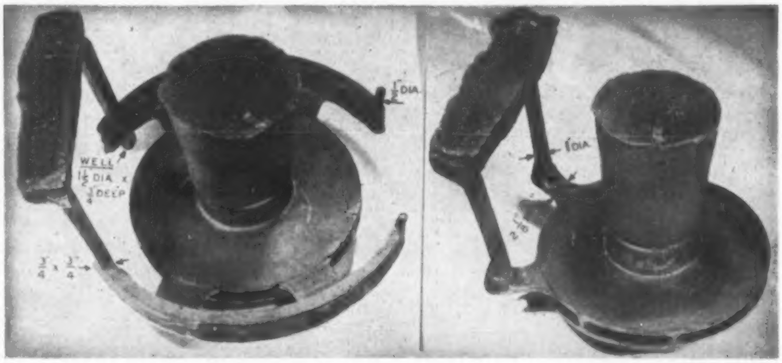
■ The figure above illustrates a gating system that proved to be unsatisfactory from the standpoint of metal cleanliness. These 85-5-5-5 castings leaked under pressure after machining. Polished and etched cross-sections of valves showed the metal to be generally sound. On further investigation, passages going completely through the walls were found as shown in the right hand picture. Factors affecting the cleanliness in this gating system are: 1) large sprue to runner size caused metal "squirting" in the runner, 2) gates for two castings came directly off the sprue base, 3) no runner extension dirt catcher beyond last gates allowed first metal to go directly into casting cavity.

Changes in gating system that produced sound castings: 1) located sprue on opposite end of runner, 2) tapered sprue and sprue well, 3) choked runner, 4) extended runner beyond last gates to trap first metal entering, 5) raised runner slightly higher than gates.

By tapering the sprue it is easier to keep it choked. The well under the sprue cushions the fall of the first metal and prevents subsequent erosion of sand underneath the sprue. Choking the metal before it enters the runner, eliminates squirting. By leading the gates from the runner back toward the sprue, metal does not enter mold cavity until runner is full.



GATING TO OBTAIN SMOOTH INTERNAL SURFACES



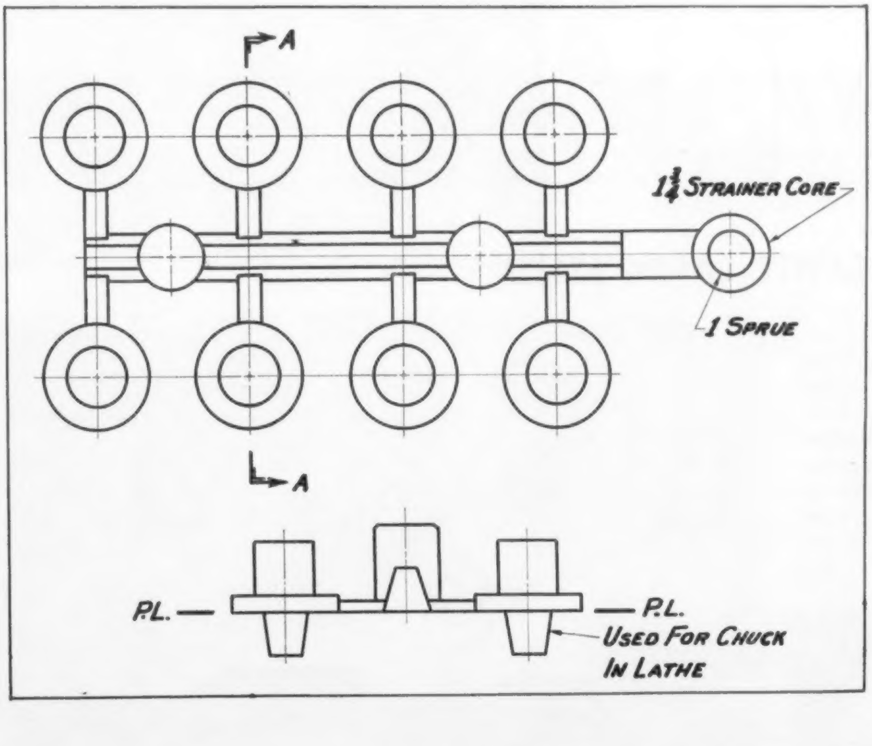
■ These two gating systems were used on impellers made from Navy "M" (88-6-2-4). With the gating system used on the impeller at the right, turbulence due to jet action of the pressure-type choke gating caused rough internal surfaces on the cored internal blades. The ingate to sprue ratio was 0.8 to 1.0

By adopting modified principles developed for AFS by Battelle Memorial Institute a non-pressure gating system was devised. Improved internal surfaces resulted. Some of the changes included:

1) rectangular tapered down sprue, 2) well at bottom of down sprue, 3) narrow deep runner having a sprue to runner ratio of 1.0 to 2.7, to reduce the velocity of the metal, 4) extension and flow-off on the runner past the last gate to trap dirty metal so it didn't enter casting, 5) sprue to ingate ratio of 1.0 to 3.0 to reduce velocity and prevent jet-like turbulence of metal entering the mold cavity.

The result was a noticable improvement of internal surfaces of the impeller.

GATING SYSTEM FOR SMALL PARTS

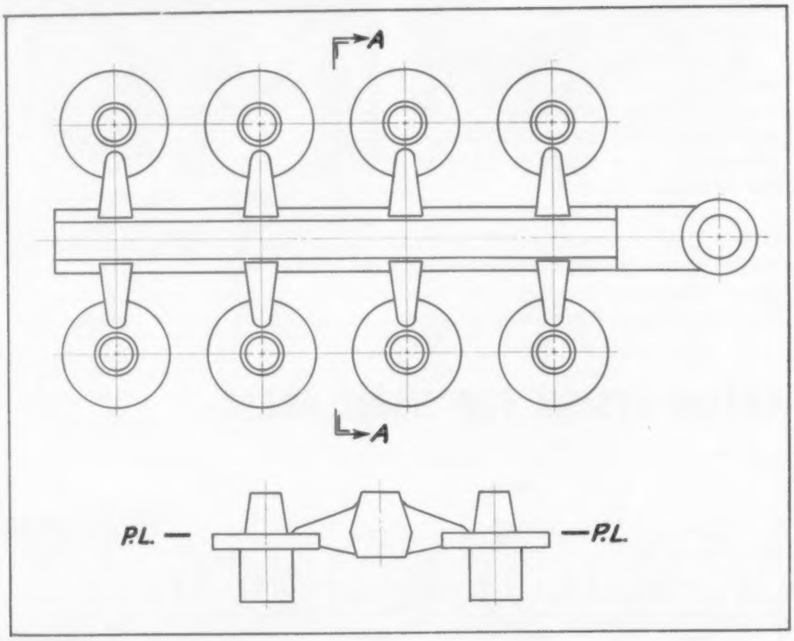


■ This gating system was used for small gears made from 85-5-5-5. The gears are approximately 2½ in. diameter by ⅜ in. thick, with a hub 1½ in. diameter and 1½ in. high. The bob riser proved too far removed and insufficient to feed four castings. Machined surfaces at the junction of hub and gear showed small irregular holes. A fracture at this point showed reddish-brown and very coarse dendrites—usually indicative of a shrink.

Page 38 shows the gating changed to overcome the shrinkage defect. The matchplate was turned over. Bob risers and old gating were removed. Runner and gates were

placed in both cope and drag. Padding the gates over the casting was found necessary, because on the first try without padding, the castings still showed some evidence of shrink. Fillets at the junction of the hub and the gear also helped to alleviate the shrinkage condition. Fractures and machined surfaces showed no evidences of shrinkage with the new gating method shown here.

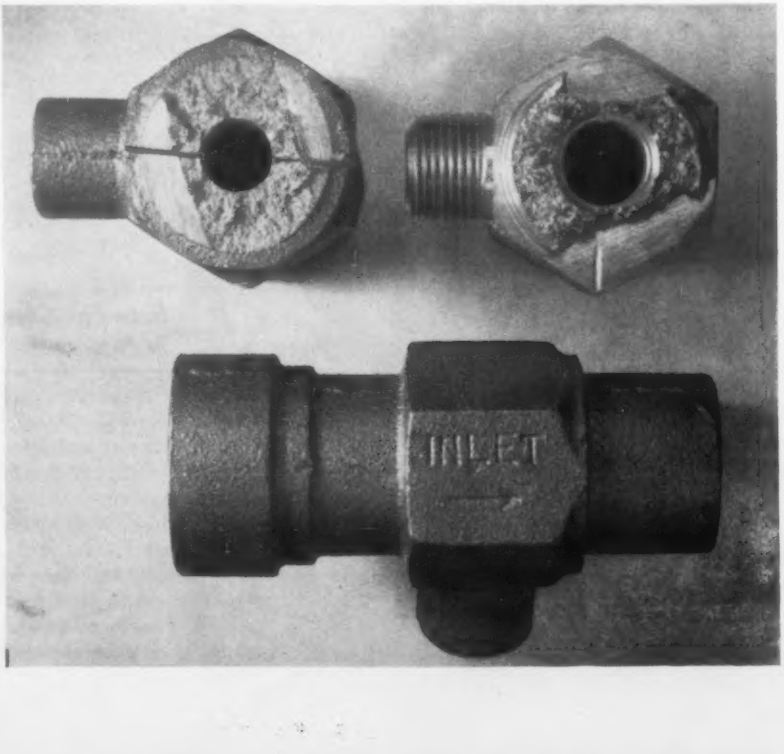
Inadequate feeding was essentially eliminated in this instance by replacing the bob risers with an oversize runner to do the feeding.



FEED IN MULTIPLE CAVITY GATING SYSTEMS

■ This is an illustration of the effect of inadequate feed in multiple cavity gating systems. This valve was made from 81-3-7-9, with eight castings in the mold. The pattern was a split plate (cope same as the drag). Even though runners and gates were in both the cope and drag, the heavy section at the valve seat was inadequately fed (as shown by the discolored fracture of casting on the right). Leakage occurred after machining.

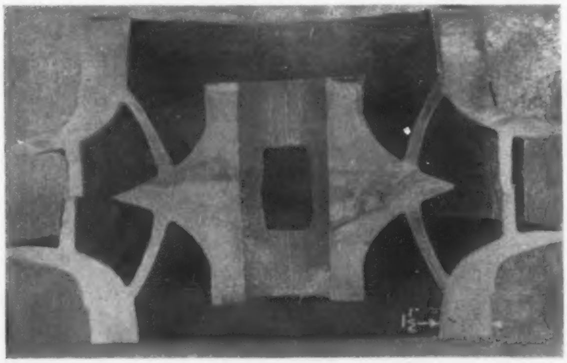
A bob riser was placed at junction of runner and gates. This proved effective for feeding the heavy section, as seen by the more uniform fracture of casting on left. Possibly a more economical but as effective method, would be to increase the size of runner and gate (runner riser). Bob riser is either attached to plate, causing excess metal in drag, or molder wastes time putting four bob riser inserts on pattern, when he makes cope.



CHILLS AND DIRECTIONAL SOLIDIFICATION

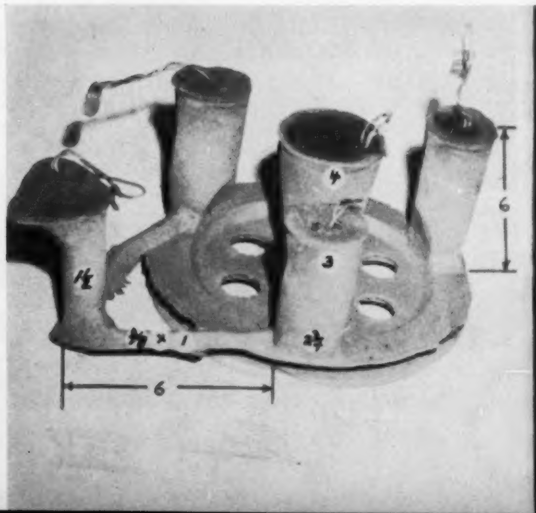
■ Shrinkage defects due to design, that is, the inability on the part of the foundryman to feed parts of a casting inaccessible to risers, can be illustrated by this Navy "M" casting. Internal shrinkage was noted at a critical section of the impeller in the drag side after machining. The cope side, which has practically an identical section, could be made sound by feeding with two top risers. The drag could not be properly fed because the casting was cast flat in a green synthetic sand mold. Two down gates were employed and three flow-offs (two off the center hub and one off the shroud opposite the gates).

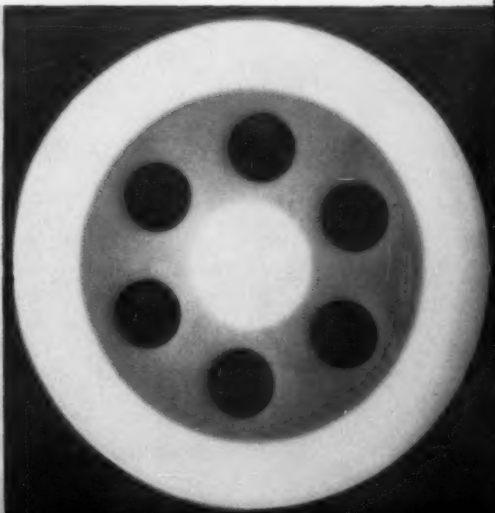
By employing chills (1 x 1 x 2 in.) on the bottom of the ring fit area and block chills (1 x 1½ x 3 in.) on the side of the ring fit (marked black in photo), directional solidification was effected at this point, eliminating the defect. The use of chills also eliminated the necessity for changing the method of risering which would still further reduce the casting yield. This method produced castings which were sound on machining and by radiographic inspection. On smaller impellers cast flat where the distance along the ring fit area (drag side) is short, it is not necessary to add chills along the side of the ring fit. A circular chill placed on the bottom is adequate and will eliminate internal shrinkage at the critical section.

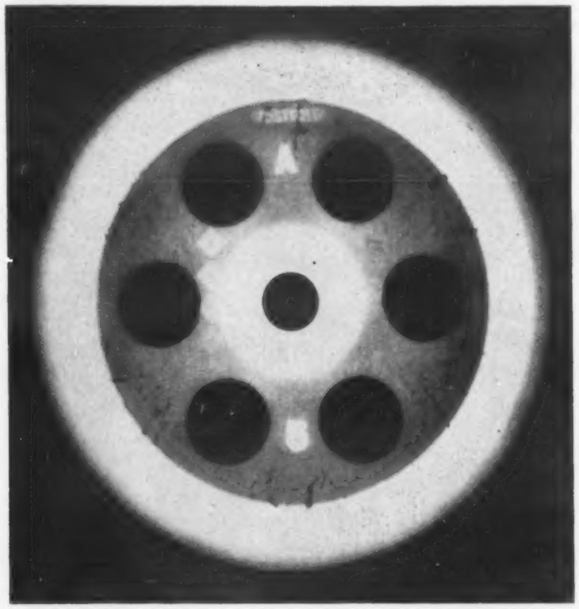


RIGGING TO AVOID SHRINKAGE AT JUNCTION OF THICK AND THIN SECTION

■ Here is the correct gating and risering of a Navy "G" bronze (88-8-0-4) sheave casting. Previous rigging practices resulted in internal shrinkage in each spoke at the junction of the thin web and heavy rope sections, as revealed on page 40. The radiograph below proves the sound casting resulting from this system.







To make this 12-in. diameter sheave, three risers were located on the top periphery of the rim and one over the hub. Two runner-gates introduced metal into the base of two of the risers.

IN CONCLUSION

■ The foregoing examples of defects caused by inadequate or poorly proportioned gates and risers are just a few of the many that are encountered by foundrymen all over the country. Gating and risering of castings is very important in the production of sound, clean, high-quality copper-base alloy castings. A thorough study of each particular casting should be made, before any decision on the type and location of gates and risers be made.

The following companies submitted data for this project:

Wollaston Brass & Aluminum Foundry, Inc., North Quincy, Mass.
New York Naval Shipyard, Brooklyn, N.Y.
Foundry Services, Inc., Columbus, Ohio
Naval Research Laboratory, Washington, D.C.
American Brake Shoe Co., Mahwah, N. J.
Federated Metals Div., American Smelting & Refining Co., Newark, N.J.
Bohn Aluminum & Brass Corp., Detroit.
R. Lavin & Sons, Chicago.
H. Kramer & Co., Chicago.
Bethlehem Steel Co., Bethlehem, Pa.
Bridesburg Foundry Co., Fullerton, Pa.
Fischer Casting Co., Dunellen, N.J.
Arrow Corporation, Webster City, Iowa
Kitson Foundry Div., Welsbach Co., Philadelphia.
Ingersoll-Rand Co., Phillipsburg, N.J.

How We Converted to WATER-COOLED CUPOLAS

John Deere Tractor Works found experience was the only teacher that could show them how to convert cupolas to water-cooling

JAMES MCCONVILLE / *Foundry Metallurgist*

ANDREW FISCHELS / *General Melting Supervisor*

John Deere Waterloo Tractor Works Waterloo, Iowa

Benefits Derived from Water-Cooled Cupola

1) **Deep burn-outs eliminated.**
2) **Refractory consumption reduced 50 per cent.**
3) **Melting rate increased 25 per cent.**
4) **More uniform melting rate obtained.**
5) **Bed height easier to maintain uniform.**
6) **Less coke required for melting.**
7) **Carbon pick-up doubled.**
8) **Silicon loss doubled.**
9) **Chemical control improved 20 per cent.**

FASTER–CHEAPER–CONTROLLED–melting of iron has resulted from converting six cupolas to water cooling at the John Deere Tractor Works in Waterloo, Iowa. This advanced step in cupola operation technology was accomplished entirely with company personnel. This story of their experiences can very well act as a guide to other foundries looking for "how-to" and "how-not-to" information for future planning.

In the spring of 1954 many favorable reports concerning water-cooled cupolas indicated a possible solution to our problem of deep burn-out. Water cooling the cupolas was given careful consideration with a view toward keeping such an installation as simple and effective as possible. This was accomplished in the decision to use a simple water spray on the cupola shell. For safety and temperature reasons water cooling was not to extend below the tuyeres.

Water cooling was first installed on two No. 9, 84-in. diameter hot blast cupolas. As the melting zones in both these cupolas were in bad condition, the lower 10 ft of the well and melting zone were replaced with a new steel shell. As illustrated in Fig. 2, a new wind drum was also made and set out from the cupola shell 14 in., to allow room for water passage and water-collector cones. Downcomers were used to deliver blast air to the tuyeres. These were long enough to raise the wind drum several feet above the operator's head, giving easy access to almost all lower parts of the cupola.

Water-collector cones were necessary wherever a row of rivets or brick-support-segment bolts protruded on the outside of the cupola shell. A small water collection trough was welded to the cupola shell immediately above the tuyeres. Drain water flowing from the top of the collection trough was used to granulate slag coming from the front slagging spout. Water was applied to the cupola shell by a spray ring located under charging floor. This consisted of 1½-in. steel pipe bent into a circle and having 1/8-in. holes drilled at a 45 degree angle to the cupola. The holes were spaced 1-1/16-in. apart. The spray ring was made in two sections for easy installation. River water pumped by the plant powerhouse was delivered through a 2½-in. supply line at about 35 psi pressure.

Water Contact Problem

The cupola was lined in the usual manner with the melting zone tapered back to a 9-in. wall about 2 ft above the cast iron tuyeres. A 9-in. lining was used until the water cooling system was operating correctly. When the water passed over the rivet heads it would not immediately flow back onto the cupola shell leaving the shell with bare spots untouched by cooling water. Once water was applied to the shell, surface tension held it until something protruding, such as a rivet head, diverted it away.

Wire screen was tried as a means of keeping water on the shell, but the water passed through instead of following it. In another effort to solve this problem a thin sheet of red packing rubber about 6 in. wide was attached to the collector cones and pulled loosely around the cupola shell. This worked fine as long as the water was running. But when the water was shut off heat from the cupola shell caused the packing rubber to harden away from the shell and be of no further value.

A more resilient rubber that would not harden with moderate heat was needed. Rubber such as that used for hot-sand-conveyor belts proved adequate. As the collector cone had a larger diameter than the cupola shell, the rubber had to be stretched on the cone so that it would lay close to the cupola shell. Considerable trouble was encountered getting uniform tension. As a result some places had an excess of water while other places had almost none. No amount of tension adjusting proved too successful. Finally the problem was solved with wire cut in short pieces and of various thicknesses pushed up under the tight places. By varying the wire thickness and distance between wires, a uniform coat of water was established with no splashing or rainstorm effect. This rubber has maintained its resilience for two years or longer and the system has proven to be quite trouble free.

Tuyere Troubles

Water cooling immediately

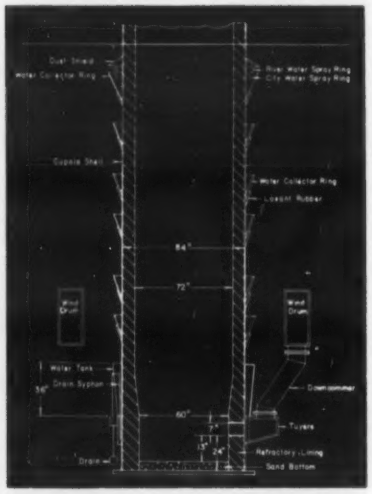


Fig. 1 . . First installation was on 84-in. hot-blast units.

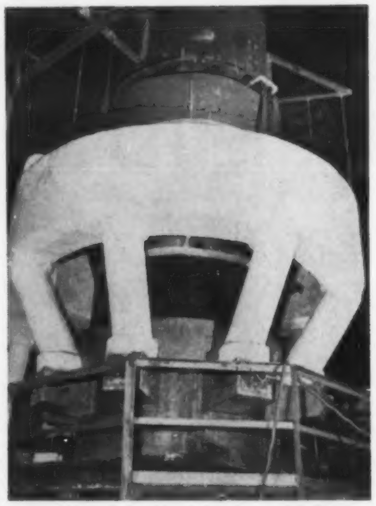


Fig. 2 . . First design solved big problem, left many others.

solved the big problem of burning through the cupola shell. However, other problems appeared. First the cast iron tuyeres would wash out because of thin lining above them. Second the melting zone lining would slip. Third, the brick-support-segment bolts snapped off when the cupola cooled down and as a result water turned on for the next heat would run down behind the lining and soak the cupola bottom sand. The intense heat of molten iron on the bottom created steam and blew sand out the door seams.

The cast iron tuyeres had to be replaced almost every heat and were expensive to make and install. Since they were the flared type with large openings and the cupola now had a much larger diameter in the melting zone, air penetration was inadequate. Eight inch steel pipes were tried as a replacement and found much better. Refractory material between the pipes from the well on up did not wash out as readily as with the cast iron tuyeres. The tuyeres were tried with 7-in. diameter steel pipe with still better results and less wash out between the tuyeres.

During this period of trying various sizes of tuyere pipe, the thickness of the refractory on the melting zone walls was reduced to about 6 in. Fig. 1 shows about 12-14 in. of lining in the well and up to about 12 in. above the tuyeres, tapering back to a 6-in. wall thickness. The brick segments were done away with and the bolt holes welded shut, eliminating the snapping of bolt heads and subsequent water leaks.

Steel pins, 5/8-in. diameter by 3-in. long were welded to the shell on top of every fifth row of block from about 4 ft above the tuyeres to about 8 ft. above them. These were spaced every 12 in. around the shell circumference. As the shell was cooled, these pins did not melt back any faster than the refractory lining. If the first row of pins melted, the next row would hold the lining above.

Cupolas Re-designed

With the first pair of water-cooled cupolas operating satisfactorily, it was decided to water cool another pair of No. 9 cupolas incorporating four changes in design as follows:

1) Offset well.
2) I-beam reinforcing.
3) Water tank around melting zone.
4) Flowing drain water from bottom of tank instead of top.

With an offset well, even though all the lining was gone in the melting zone, the tuyeres remain intact and carry on their normal function, as they are out of the way of any washdown from iron and slag typical of a straight shell. This would be especially valuable if rear slagging were used.

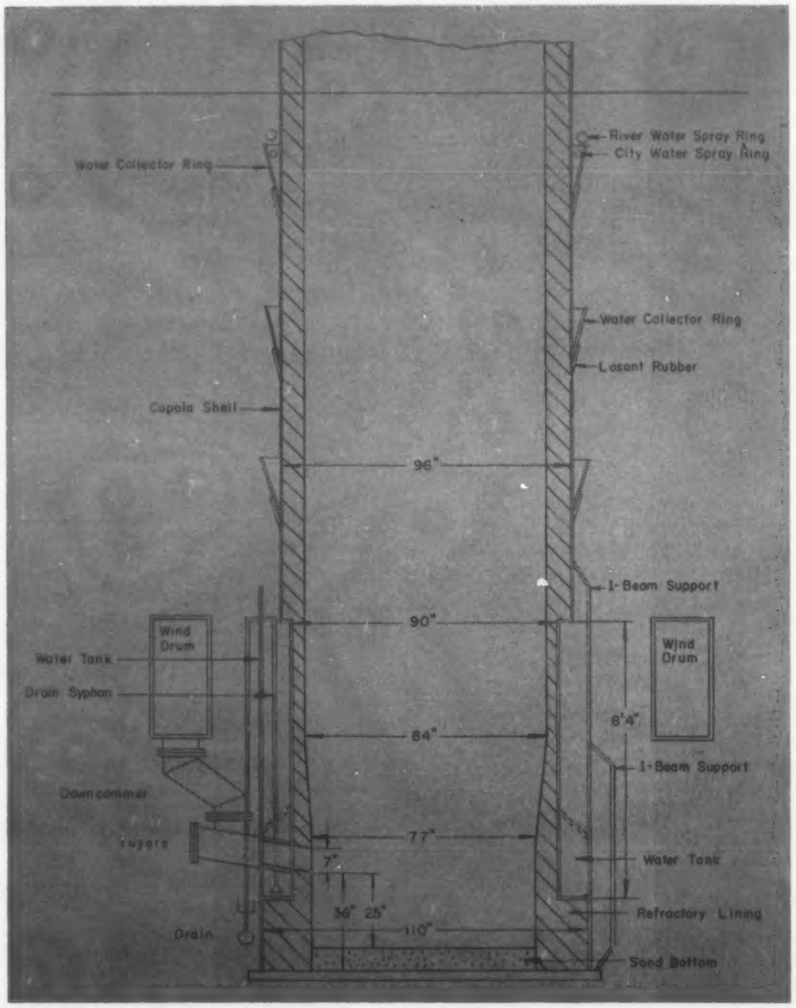


Fig. 3 . . Ultimate design has absolute minimum of refractory lining which increases production and improves control of melting conditions.

A number of reasons existed for installing a water tank around the melting zone instead of a water collector trough above the offset well. With only one source of water and practically no lining a pump failure would lead to a melt through the shell in a minute or less. This tank is 38 in. high, 10 in. thick, and covers the hottest part of the melting zone. In case of water pump failure the drain valves could be closed and the tank kept full of water. By shut-

Fig. 4 . . Syphons (vertical pipes) help maintain positive water level in newest system.

Fig. 5 . . Re-designed tuyere insulates hot blast from the water flowing around the tuyere.

Fig. 6 . . Cupola lining after 18 hours use. After each heat, 3 to 4 in. of lining are added.

ting off the air blast immediately, the water in the tank will prevent a hole being burned through the shell of the cupola possibly causing it to buckle.

The tank also eliminates thin spots in the flow of water down the shell. If the water layer is too thin, it has a tendency to part from the hot spot and a small hole could be burned through the shell before being noticed. The water is drained from the tank bottom to promote circulation and bring colder water toward the bottom of the tank. With the offset well, only 4 in. of refractory were used in the melting zone since the tuyeres were protected under the cone away from the wash down of slag and metal.

Although this design was superior to the straight shell design, all problems were not eliminated. There was still refractory above the tuyere pipe under the cone. During long heats this area will erode, leaving the cone exposed to very high temperatures. The flow of cooling water must be increased to keep the tank from boiling. No harm comes from boiling but more water is required and the refractory must be replaced before the next heat. This burn-out under the cone does not effect the tuyeres, since it never goes deep enough.

Later Modifications

After operating about a year with the four No. 9 water-cooled cupolas, it was decided to water cool the two No. 10 cupolas. In designing these, two more features were incorporated to further improve them over the No. 9 cupolas. These features were:

1) Water-cooled brick shelf.
2) Positive water level.

A water-cooled brick shelf was especially needed to hold the upper lining in a positive way. Also a positive water level had to be maintained to protect the brick shelf. In order to create this brick shelf, the diameter of the shell was reduced from 96 in. to 90 in. in the area six ft above the tuyeres. Joining the two shells with a flat plate provided a shelf to support the upper lining. I-beam supports come up under the shelf at eight equally spaced points, giving added strength to support the upper part of cupola.

The water tank was extended from the cone to 12 in. above the brick shelf. To maintain a constant water level in the tank a syphon-type of drain system was installed using 2-in. pipe. Starting at the cone inside the tank, the pipe goes to within 6 in. of the top of tank, then through and down the outside to drain cups. There are eight of these syphons in the tank. The drain cups are connected to the main drain line that conveys the water to the slag trough. The drain cups make it possible to observe if the proper amount of water is flowing down the cupola and through the tank, and to check the water temperature.

For further safety in case of water failure, each syphon is equipped with an air break at the top. When the tank water level drops to that point, the admission of air breaks the syphon action and the tank cannot be emptied. Tests have been made by shutting off water and blast air at the same time. At the end of 10 minutes the water in the tank had not boiled. In other instances, the tank water boiled because of insufficient supply, but when the air blast was shut off the boiling stopped. The tank of water would probably hold the cupola until any trouble with the water supply could be corrected.

An auxiliary water system connected to the city water line was also installed. Now if a pump failure occurred at the plant powerhouse, water would still be available. This tank and syphon system has since been installed on the No. 9 cupolas.

New Tuyeres

It was now felt that all the problems had been corrected except the burn-out under the cone. This difficulty was alleviated by extending the water tank to a point just below the tuyeres. Fig. 3 shows the final design incorporating all the changes. The tuyeres were re-designed to make them adaptable to this change, to increase flexibility as to tuyere size and to insulate the hot air coming from the preheaters to the cupola. Slots 2-in. wide by 6-in. long were cut at intervals around the cone. These served to let the water run down around the tuyeres and permit the syphon drain pipe to extend below tuyeres.

The 90-in. diameter melting zone sections were extended down about 30 in. A circular flat plate was welded to this section and to the cupola shell. The tuyeres were prefabricated of 10-in. inside diameter steel pipe. Tuyere door flanges were welded on the outside of the pipe. This gave a full 10 in. diameter opening from the outside to the inside of the cupola.

The inside diameter of the 10-in. tuyere is lined with a fire clay-silica sand mixture, and a 7-in. diameter sheet metal tuyere pipe is pushed through. This pipe, as long as the tuyere, insulates the hot blast air from water flowing around the tuyere. With cooling water below the tuyeres, all combustion takes place within the water cooled section of the shell.

Reduced Lining

These cupolas have 14 in. of refractory lining in the well and 4½-in. in the melting zone when newly lined; after the first heat, 3 to 4 in. of lining are put in the melting zone.

A small amount of lining in the cupola is advantageous at the start of the heat, since it contributes to a hotter first tap. As the lining erodes back, with proper flux control the last inch or so will last longer because of the water cooled shell. Proper flux control also saves refractory in the cupola well, breasts and spouts.

Along with elimination of deep burn-outs, additional benefits were derived from water cooling. The cupolas are operated with a minimum of lining and on the bare shell. In normal operation a slag coating adheres to the shell, helping to insulate the shell from the super-heat area and preventing loss of temperature through the shell. For that reason a lining is put on the shell to give this insulation.

Water cooling reduced refractory material 50 per cent. Prior to water cooling, 25.7 lb. of refractory per ton of melt were consumed from the cupola lining. After water cooling, this dropped to 12.5 lb. of refractory per ton of melt.

Improved Melting

The melting rate increased 25 per cent. Cupolas that had been lined to 54 in. inside diameter were now 75 in. inside diameter. This is the same as increasing the cupola 3 sizes, from a No. 7 to a No. 10.

A much more uniform melting rate also was obtained. Before water cooling, a gradually increasing cupola diameter had to be compensated for by charging additional coke in order to keep the coke bed at the proper operating level. With water cooling and only 4 in. of lining to burn out, as against 16 in. of lining prior to water cooling, a much more uniform bed

height was maintained.

For example, with a bed height of 70 in. and a lined diameter of 54 in., 4000 lb. of coke was required for the bed. With water cooling and a 70-in. bed height but with a lined diameter of 76 in., 7000 lb. of bed coke is required. This indicates that with a deep burn-out, prior to water cooling, an additional 3000 lb. of coke had to be added just to keep the bed at proper operating height.

In December, 1954, a coke unloading and screening system was installed. With the increased diameter of cupola, and removal of coke fines, melting rate increased 50 per cent. Because of this increase in melting rate, it became increasingly difficult to keep the cupola full. To help overcome this problem the metal charge was increased from 4000 lb. to 5000 lb. The coke split was kept at 500 lb. per charge. Later it was possible to reduce the coke split to 450 lb. for each 5000-lb. metal charge. Much of this improved melting efficiency resulted from maintaining bed height so uniform.

Chemical Control

As cupola linings were reduced an increase in carbon pick-up was noted. Prior to water cooling, carbon pick-up was in the range of 20 to 30 points, but with the change, pick-up became 40 to 50 points. This increase probably occurred because the operation was much less acid or possibly neutral. The limestone used is approximately 25 per cent magnesium carbonate, undoubtedly accounting in part for the higher carbon pick-up. Now instead of continually striving to hold carbons above the minimum, they stay uniformly high.

Along with increased carbon pick-up, an increased silicon loss was also noted. Prior to water cooling, with a hot blast operation, silicon loss of 15 points could be expected. After the conversion, silicon loss rose to 30 points, which is probably the result of the change from an acid operation to one that is much less acid or possibly neutral.

Temperatures were maintained in the same range as formerly, with no increase in coke splits. On the contrary, coke was reduced. In some instances the temperature at the spout is 20 F lower than average, but the increased volume passing through the forehearth has kept the metal at the same temperature going to the molding units as it was before water cooling.

Chemical control improved considerably. Past records indicate that carbons fluctuated in a 30 point range, and silicons were held in a 20 point range. Using the short formula, $CE = TC + 1/3\ Si$ and plotting the high carbon and silicon taps against the low carbon and silicon taps, the spread is 37 points. Since water cooling the carbon range is 0.20 per cent and silicon range is 0.30 per cent. If once again the carbon equivalent formula is used, plotting the high carbon and silicon against the low carbon and silicon, a spread of 30 points is obtained. This indicates a 20 per cent improvement in ability to maintain uniform quality of metal poured in castings in the foundry.

Two cupolas are operated each day. With the increased tonnage obtained by water cooling, the same amount of metal is produced in 16 hours from two cupolas that formerly would have required three or possibly four cupolas. Certain operational techniques are necessary. Spray rings must be checked several times a day, and plugged holes opened. The collector tank is drained and cleaned after each heat. Water is not turned on until the cupola is fanned. A leak into the cupola during operation was of no consequence. However, a leak prior to starting would run down inside the cupola, soak the bed sand and bed leaks could be expected.

As stated earlier, river water is used for cooling. As a result, incoming water temperature varies with the seasons of the year. The water temperature rise at the drain line is an average of 70 F. Water is applied to the cupola shell at a rate of 100 gallons per minute.

In conclusion, the authors wish to thank the John Deere Waterloo Tractor Works; Mr. W. R. Jennings, foundry superintendent; Mr. L. Dunaway, cupola repair foreman; and other supervisors, engineers and personnel in the foundry for their efforts in making water cooling of the cupolas a successful operation.

WATER-COOLED CUPOLAS
Operating in the United States

Name	Location
A. M. Byers Co.	Economy, Pa.
Albion Malleable Iron Co.	Albion, Mich.
American Cast Iron Pipe Co.	Birmingham, Ala.
American Radiator & Std. Sanitary Corp.	Baltimore, Md.
American Radiator & Std. Sanitary Corp.	Louisville, Ky.
Auto Specialties Mfg. Co.	Benton Harbor, Mich.
Auto Specialties Mfg. Co.	St. Joseph, Mich.
Belle City Malleable Iron Co.	Racine, Wis.
Buick Motor Div., GMC.	Flint Mich.
J. I. Case Co.	Racine, Wis.
Central Foundry Div., GMC.	Danville, Ill.
Central Foundry Div., GMC.	Defiance, Ohio
Central Foundry Div., GMC.	Saginaw, Mich.
Central Iron & Steel Co.	Harrisburg, Pa.
Centrifugal Fusing Co.	Lansing, Mich.
Chicago Malleable Castings Co.	Chicago
Cincinnati Milling Machine Co.	Cincinnati
James B. Clow & Sons	Conshocton, Ohio
Columbia Malleable Castings Co.	Columbia, Pa.
Deere & Co.	Moline, Ill.
John Deere Planter Works.	Moline, Ill.
John Deere Tractor Works.	Waterloo, Iowa
Delco-Remy Div., GMC	Anderson, Ind.
Eljer Co.	Salem, Ohio
Florence Pipe Foundry & Machine Co.	Florence, N. J.
Ford Motor Co.	Cleveland
Ford Motor Co. (Iron Foundry)	Dearborn, Mich.
Ford Motor Co. (Specialty Foundry)	Dearborn, Mich.
Ford Motor Co.	Cleveland
General Electric Co.	Elmira, N. Y.
Glamorgan Pipe & Foundry Co.	Lynchburg, Va.
Globe Steel Abrasive Co.	Mansfield, Ohio
International Harvester Co.	Memphis, Tenn.
International Harvester Co., McCormick Works.	Chicago
International Harvester Co., Research.	Chicago
International Harvester Co.	Waukesha, Wis.
Interstate Foundry Co.	Indianapolis
Kelsey-Hayes Wheel Co.	Detroit
Kuhn Brothers Co.	Dayton, Ohio
Laclede Steel Co.	Alton, Ill.
W. O. Larson Foundry Co.	Grafton, Ohio
Lynchburg Foundry Co.	Lynchburg, Va.
Lynchburg Foundry Co.	Radford, Va.
National Malleable & Steel Castings Co.	Cicero, Ill.
National Malleable & Steel Castings Co.	Cleveland
National Malleable & Steel Castings Co.	Indianapolis
Neenah Foundry Co.	Neenah, Wis.
Noblesville Casting Co.	Noblesville, Ind.
Ohio Malleable Iron Co.	Columbus, Ohio
Perfect Circle Co.	Richmond, Ind.
Pontiac Motor Div., GMC.	Pontiac, Mich.
Saginaw Malleable Iron Co.	Saginaw, Mich.
Savannah Machine & Foundry Co.	Savannah, Ga.
Sheffield Steel Co.	Kansas City, Mo.
The Stanley Works.	Bridgeport, Conn.
Tyler Pipe & Foundry Co.	Tyler, Texas
Universal Foundry Co.	Oshkosh, Wis.
Wagner Foundry & Pipe Co.	Decatur, Ill.
Warren Foundry & Pipe Co.	Phillipsburg, N. J.
Wheland Co.	Chattanooga, Tenn.
Zoller Castings Co.	Beltsville, Ohio

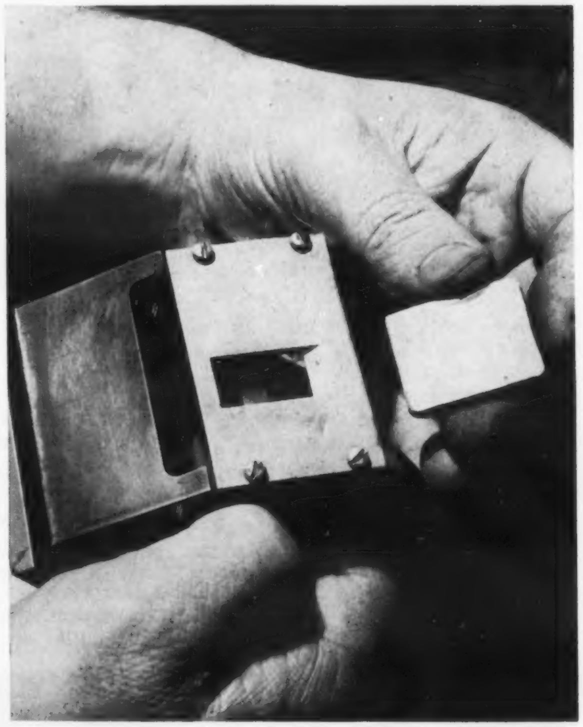
This list was prepared by Walter R. Jaeschke, Whiting Corp., Harvey, Ill., and the MODERN CASTINGS staff. Readers who know of installations not in the list are invited to write the editor so that the list may be made more complete.

X-RAYS SPEED CHEMICAL ANALYSIS

R. D. Ahles / *Manager*
Product Engineering
Foundry Department
General Electric Co.
Schenectady, N. Y.

General Electric foundries use new device to slash time required for analysis by 80 per cent

A complete chemical analysis of this test wafer will be ready for the foundry in just minutes.



Sample of the heat is cast, cleaned, placed in a holder and the analysis is ready to begin.

The Foundry Department of General Electric Company had a problem—how to maintain process control with a rapidly increasing chemical analysis load. Plaguing the over-loaded laboratories were these two factors (1) increased production of low alloy castings in the steel foundry (2) expanded output of high alloy castings for aircraft and turbine applications. The result—severely overtaxed personnel and equipment of the chemical laboratory. So much so that even rapid colorimetric methods could not satisfy increased demands for accurate analyses.

A thorough study of the problem indicated that x-ray spectrometry would provide a low-expense solution. Subsequent performance of an x-ray emission spectrometer demonstrated that rapid, accurate analyses could be obtained to a greater degree than anticipated!

Specifically, analysis of such elements as chromium, manganese, nickel, vanadium, molybdenum, tungsten, cobalt, copper, columbium, and iron can be determined in a matter of *seconds* compared to *minutes* by wet analysis. And this is true whether the element be a major constituent or a residual. Furthermore, the accuracy by x-ray means is as good or better than the wet chemistry analytical methods.

This is of great interest to the analytical chemist whose busy world encompasses precise weighings, time-consuming separations, titrations, and ignitions. Indeed, many a veteran chemist is startled by the almost incredible speed of x-ray spectrometry. Some wet analyses that take days can be determined in a few minutes. Installation has greatly increased the capacity of the chemical laboratory.

A brief description of the x-ray spectrometer technique follows. A strong source of x-rays is directed to the sample which can be a solid, powder, or liquid. When these x-rays have sufficient energy, ionization within the atom causes emission of secondary x-rays. These x-rays are characteristic of the elements within the sample. That is, each element has its own characteristic emission lines or spectrum.

The emitting secondary x-rays from the specimen are collimated or channeled to an analyzing crystal. It is the function of the latter to disperse the various characteristic wave lengths. The crystal does this by behaving as a three-dimensional diffraction grating. Only those wave lengths of elements that satisfy the Bragg equation are diffracted—$n\lambda = 2d \sin \theta$, where n is the order of diffraction, λ, the wave length in angstroms, d, the distance between atomic planes of the crystal, and θ, the angle between incident radiation and diffracting planes.

In x-ray spectrometry, as opposed to diffractometry, the value d is known. Qualitative analysis of elements is accomplished with a device called the spectrogoniometer which rotates the crystal through various angles. This scanning procedure results in peaks recorded on a chart. The peaks correspond to specific, so-called, "two-theta angles" of the spectrogoniometer. To obtain the identity of the element, the operator simply consults available tables which list two-theta values with their corresponding elements. The table also provides direct reading of the wave length.

For quantitative analysis, the spectrometer is usually set to the element desired, as determined by its diffraction peak. In general, intensity of radiation is linearly proportional to the element's concentration. A detector or counter tube, also mounted on the spectrogoniometer, detects the x-radiation and converts it into electrical impulses.

The impulses are amplified and counted for a preset time by a scaler. Actual analytical information is readily obtained from a

Simple setting adjusts a crystal which performs the analysis by identifying the wave length of each element present in the sample.

curve calibrated in counts-per-second vs. element percentage. Standard curves are constructed by plotting intensity of emission vs. the alloy content of standard or known samples.

Spectrometry vs. Wet Chemistry

Analysis times for elements analyzed in low alloy and carbon steels have decreased from approximately 160 to 30 man-minutes with the use of x-ray equipment. Preliminary analysis for Cr, Mn, Mo and Ni, ordinarily required 50 man-minutes with an elapsed time of 20 minutes. These same elements, along with others previously not determined because of longer delays—Cu and V—can now be done in 6 man-minutes with an elapsed time of 6 minutes including sample preparation. *The ability to run these rapid analyses has increased the number of in-process checks with resulting higher chemical control, casting uniformity, and quality.*

Steel Analysis—Spectacular

The time saving for stainless steel or high temperature alloys is even more spectacular. Analyses for Cr, Mn, Ni, Co, Cb, Mo, and V, in widely varying percentages, can be determined at the rate of one every 30 seconds, after a 2-minute sample preparation on a belt grinder. The analysis of materials such as AISI 316 or 347, X40, S816, etc., has been reduced from a matter of hours to minutes. In a representative week before the equipment was installed, 185 analyses (elements determinable by emission method) were made by a chemist working overtime. Now, using emission techniques, 435 analyses are run per week, with about 10 per cent less working time.

Elements with atomic numbers above 12 can be analyzed on the latest-type equipment. Experimental work has established that silicon can be determined in steels with special techniques, but running this analysis on a production line has yet to be fully realized.

Advantages

The usefulness of x-ray emission spectrometry as a foundry tool is just beginning to be appreciated. It will only be a matter of time before it receives extensive application for slag analysis and control, in-coming material acceptance, and sand reclamation.

A decided advantage made possible with the x-ray instrument is the reduction of chemical variations from heat to heat, particularly in the case of manganese and chromium. Little difficulty is experienced in controlling these values to within plus or minus 0.03 per cent.

Experience indicates that x-ray emission spectrometry can make a decided contribution to steel melters. Stainless steel producers should be particularly interested because of the rather slow and tedious anlyses required in that industry. Where it has cut our time to 1/5, it would probably cut theirs to 1/10. Further savings, in the cost of nickel alone, amount to as much as $500 per 8-ton heat by holding within, but on the low side of specifications.

In summary, the advantages of x-ray emission spectrometry are:

- Speed of analysis—10 seconds to 5 minutes depending upon analytical accuracy desired.
- No sample weighings, filtrations, titrations, ignitions.
- Lower cost.
- Non-destructive analysis—sample is not destroyed. (Invaluable in rare-metal and police work).
- Analysis of rare earths and platinum metals where separations are difficult.
- Sample may be solid, powder, or liquid.
- Simple x-ray spectra. Considerably fewer lines than those obtained by optical spectroscopy.
- Non-destruction of standard.

Pushbutton starts counter tube which converts the x-radiation to measurable electrical impulses.

Recorder shows reading which is converted into analysis reading with calibration curves.

Heat transfer paper by Dr. V. Paschkis, speaking, was followed by a spirited discussion period. Dr. W. K. Bock, on left, presided.

CASTINGS CONGRESS NEWS STORY—PART 2
ADVANCE OF TECHNOLOGY

Continued from page 28
base alloys as they solidified ingot molds. An electromagnetic vibrator was used for treating at 60 cycles per second. To induce ultrasonic vibrations at 20 kilocycles a magnetostriction generator was employed.

As the result of many experiments, vibration was found to be a potent grain refiner of alloys that solidified as single phase solid solutions, such as aluminum- 4.5 per cent copper and yellow brass. The higher frequency vibration was more effective a grain refiner than the lower one.

In response to questions, Mr. Freedman explained that the pressure waves generated by vibration will also grain refine pure metals. He stated that the effects of vibration are not a function of vibration frequency, but depend on the magnitude of energy that can be put into the melt.

Investigation of Metallurgical and Mechanical Effects in the Development of Hot Tearing, H. F. Bishop, C. G. Ackerlind, and W. S. Pellini, Naval Research Laboratory, Washington, D. C. In previous work at the Naval Research Laboratory, hot tearing of steel was observed to occur at a stage of solidification when interdendritic liquid films were present. In this paper the speaker told how that study was extended to cover a variety of other metals.

It was discovered that all alloys pass through a critical hot tearing or cracking temperature range where they have nil ductility and strength. Metals have high hot-tearing tendencies if they show high contraction rates at sub-solidus temperatures. The presence of low-melting segregates and a coarse grain size also increase hot tearing tendencies.

Adhesion of Phenol-Formaldehyde to Various Refractory Oxides, J. K. Sprinkle, General Electric Co., Schenectady, N. Y., and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

In order to better understand the mechanism of bonding refractories with phenol-formaldehyde (as done in the shell molding process) the authors devised a test that would measure the "work of adhesion". This adhesion characteristic proved to be a function of the liquid-solid contact angle.

The speaker described tensile tests that substantiated the calculated work of adhesion results. In both cases the contact angle, the work of adhesion and tensile strength of the refractory oxides investigated were in the following order, from lowest to highest; (1) magnesia, (2) alumina, (3) zirconia, (4) silica, and (5) zircon.

The discussion following the paper amplified the author's observations. One foundryman reported a study of coated sands which showed that these sands fracture in the resin-bridge, not at the sand-resin interface. Coated sands were observed to have a higher tensile strength than uncoated sands with the same resin control.

The Effects of Gaseous and Solid Addition Elements on the Surface Tension and Contact Angle (on graphite) of Various Iron-Carbon Alloys, Jack Keverian, General Electric Co., Schenectady, N. Y. and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass. The research described by the speaker was conducted in order to learn more about the mode of solidification of cast iron. A sessile drop apparatus was built to measure the surface tension and contact angles of various iron alloys.

As the result of many measurements it was determined that the liquid-gas surface tension of a high-purity iron-carbon saturated alloy at 1200 C is 1730 dynes/cm ± 6 per cent and its contact angle on graphite is 121 degrees ± 3 per cent. The effects of C, O_2, S, and Ce on these properties were measured.

Effect of Ferro Silicon and Magnesium Inoculation on Formation of Nuclei in Cast Iron, Fredrik Hurum, Oslo, Norway. Presented by T. McLeer, Massachusetts Institute of Technology, Cambridge. Mr. Hurum's paper discussed a study of the phenomenon of graphite spherulite formation following the addition of ferrosilicon to iron-carbon melts to obtain undissolved pieces of ferrosilicon embedded in a cast iron matrix. These areas were studies by microscopic examination.

As a result of this work it is shown that ferrosilicon absorbs considerable quantities of iron from the surrounding melt before it dissolves. Addition of magnesium to the melt causes silicon-carbides to form inside undissolved ferrosilicon and promotes diffusion of carbon into the silico-austenite.

Brass and Bronze

Pressure Tightness of 85-5-5-5 Bronze Castings, Brass and Bronze Research Progress, R. A. Flinn, University of Michigan, Ann Arbor, Mich. Mr. Flinn, emphasized that pressure tightness of 85-5-5-5 bronze castings is the most important requirement in its engineering applications. Included in his report was the description of a sensitive and reproducible test bar and leak test developed. He reported that in samples with interconnected porosity the leak rate is approximately inversely proportional to the specimen thickness. With disconnected porosity, it is necessary to employ specimens with the thickness of the same order of magnitude as the voids to obtain leakage.

Fracture Characteristics of Copper-Base Alloys, N. C. Howells and E. A. Lange, Naval Research Laboratory, Washington, D. C. This research project dealt with the fracture characteristics of 15 navy copper-base alloys. Results of drop-weight and Charpy V tests conducted at temperatures between 210 F and -300 F show fracture relationships of copper-base alloys to be different from those of steel, in that a Charpy V energy level of 10 ft-lb. does not indicate a brittle condition for copper-base alloys. Only a copper-base alloy with abnormally low tensile elongation value, less than 2 per cent, fractured in a brittle manner. However, the speaker said the ductility of high-tensile manganese bronze becomes very low at temperatures below -100 F.

Castings Design Clinic, R. B. Fischer, Ingersoll-Rand Co., Phillipsburg, N. J. presiding. Panel members—F. L. Riddell, H. Kramer & Co., Chicago spoke on gating. G. F. Watson, American Brake Shoe

Co., Mahwah, N. J. and R. A. Colton, American Smelting & Refining Co., Federated Metals Div., Newark, N. J., spoke on design of castings. The speakers, through the use of slides, presented typical examples of problems and recommended possible solutions. Discussion was invited from the floor.

Cooperation for Technical Advancement in the British Bronze and Brass Foundry Industry, A.H.R. French, J. Stone & Co.; E. C. Mantle, British Non-Ferrous Metals Research Association, England. This paper was presented by R. W. Ruddell, Foundry Services, Inc., Columbus, Ohio. The authors discussed the Association of Bronze and Brass Founders, The British Non-Ferrous Metals Research Association, and the part which each plays in non-ferrous activities. These two associations have collaborated closely in projects to increase the industry's efficiency. At present they are cooperating in a survey of the various kinds of melting equipment used in the bronze industry.

How Was The Show?

■ At the 1st Engineered Castings Show, **Robert J. Buchwalder,** staff assistant to chief engineer, Harris Seybold Co., Dayton, Ohio, told MODERN CASTINGS that it was, "An interesting show but not slanted enough for design engineers. Some exhibits appeal to designers but too many are pointed to foundrymen. We are looking for ways to cut machining costs and better tolerances than produced by the usual foundry. In my opinion, the show should appeal more to the imagination of designers."

Relation of Microhardness and Stresses in Copper Alloys, P. J. LeThomas, Association Technique de Fonderie de France, Paris, France, Official Exchange Paper. Mr. LeThomas described his research work using charts and graphs to show effect of microhardness and stresses. He described his method of testing for hardness which differed from equipment used in the United States. In the discussion period Mr. LeThomas stated that France historically has conducted research projects such as these calling for highly specialized testing and observation techniques.

Brass and Bronze Round Table Breakfast

Presiding were H. L. Smith, Federated Metals Div., American Smelting & Refining Co., and R. J. Keeley, Ajax Metal Div., H. Kramer Co. Three panel members participated in discussion *"Carbon Dioxide Process in the Brass Foundry."* They were: P. H. Ducharme, Doran Manganese Bronze—Columbian Bronze Corp., Brooklyn, N. Y.; J. E. Gotheridge, Foundry Services, Inc., Columbus, Ohio; and C. T. Koehler, Hamilton Brass & Aluminum Castings Co., Hamilton, Ohio. The speakers covered some of the basic principles of the CO_2 process, dealing primarily with sands and binders. It was brought out that the base sand must be closely controlled because it is the source of many serious troubles and a high percentage of scrap. Clay and fines in sand must be held to a minimum, otherwise a higher percentage of binder will have to be used. The speakers pointed out that usually 65-70 AFS gfn sand is used with a 3 or 4-screen spread. The sand must be round-grain, clay-free, and contain less than 0.2 per cent moisture. Defects and their causes were listed as: (1) scabbing, due to overgassing or clay and fines in the sand; (2) dirty castings, due to overgassing or clay and fines in sand; (3) veining, due to improper binder ratio; (4) penetration, due to coarse grain size.

Effects of Geometry on the Properties of Gun-Metal (88-8-4) Castings, W. H. Johnson, formerly with Naval Research Laboratory, Washington, D. C., now with Battelle Memorial Institute, Columbus, Ohio. In Mr. Johnson's paper, tensile strength and elongation were determined at various locations in vacuum degassed and non-degassed gun-metal castings of different thicknesses and geometries. These properties were compared with those obtained from separately cast test bars. The gun-metal castings exhibited pronounced edge-to-center effects. The mechanical properties varied from values higher than the test bars to values considerably lower. Vacuum degassing did not always improve the mechanical properties, and in some cases it had a deleterious effect. Mr. Johnson observed that to obtain the utmost in soundness, measures such as chilling should be used in conjunction with vacuum degassing.

Production and Properties of Iron and Aluminum Alloyed Cast Cupro-Nickel, G. L. Lee, International Nickel Co., Bayonne, N. J. Mr. Lee described the development of a cupro-nickel alloy designed for meeting marine service requirements. This alloy containing 12 per cent nickel and 1.5 per cent aluminum has a tensile strength of 95,000 psi. It also contains Mn 0.6 per cent Fe, and is deoxidized with 0.05 per cent each of P, Ti, and Ca. This alloy is suitable for pressure and structural castings for use under severe marine corrosion conditions.

Gray Iron

Inoculation of Gray Cast Iron, N. C. McClure, Dow Chemical Co., Midland, Mich.; A. U. Khan, Whirlpool and Seeger Corp., St. Joseph, Mich.; D. D. McGrady and H. L. Womochel, Michigan State University, East Lansing, Mich. The authors reported on their investigation of the relative effectiveness of some silicon alloys and active metals as ladle additions. Their investigations showed that the element silicon and silicomanganese are not effective as inoculating agents. The inoculating ability of various commercial grades of ferrosilicon was found to increase with the calcium and aluminum content. Silicon-manganese-zirconium alloys containing more calcium than is found in commercial ferrosilicon were more effective than ferrosilicon. The most effective inoculant for the improvement of mechanical properties was a calcium-silicon

Center of attention is R. G. Megaw, seated. Standing from left; F. C. Quigley, N. C. Howells, E. C. Zirzow, J. V. Leininger, R. L. Young.

Industrial engineering session had M. O. Johnson and E. C. Reid as presiding officers. L. L. Randolph and J. A. Wagner were the speakers.

alloy with approximately 30 per cent calcium, the authors stated.

Carbon Refractories, G. B. Tatum, National Carbon Co., Div. Union Carbide Corp., Cleveland. Mr. Tatum discussed the variety of carbon shapes that are used for refractory lining in foundries. He pointed out that certain combinations of materials have been found most satisfactory for particular cupola designs and operating conditions and detailed these recommendations. The construction and maintenance features of carbon shapes for use in the cupola were also discussed by Mr. Tatum.

Gating of Gray Iron Castings, J. F. Wallace and E. B. Evans, Case Institute of Technology, Cleveland. The authors reported on the results of an investigation conducted under sponsorship and direction of the AFS Gray Iron Division Research Committee. This report covered the first phase of an evaluation of existing literature on gating and risering gray iron. The authors presented formulae for selecting an optimum pouring rate or time and for the design of the gating system.

Feed Metal Requirements for Nodular Iron Castings, C. C. Reynolds, J. Maitre, and H. F. Taylor, Massachusetts Institute of Technology, Cambridge. The authors stated that they began their investigation because of its importance in determining the yield on castings and the percentage of scrap due to lack of feeding. Conclusions drawn from the study included the following: (1) Ductile iron castings remain a mixture of liquid and solid throughout most of the casting during the entire solidification time which results in gross and sponge type shrinkage. (2) Precipitating graphite is beneficial in lowering feed metal requirements, and if present in sufficient amount many castings can be made in rigid molds without risers. (3) The main effect of increasing silicon is allowing more graphite to precipitate because of the decreased solubility of carbon in austenite.

Tin as a Useful Alloy in Gray Iron, J. A. Davis, Battelle Memorial Institute, Columbus, Ohio; D. E. Krause, Gray Iron Research Institute, Columbus, Ohio; H. W. Lownie, Jr., Battelle Memorial Institute, Columbus, Ohio. The authors report that although tin has been regarded as an undesirable element in iron and steel, and has been considered to have an embrittling effect on gray iron, it can actually have a desirable effect. Their report showed that judicious use of tin promotes full pearlitic matrix microstructures in gray iron with a high degree of predictability and control. The pearlitic microstructure is highly desirable for many applications, especially those involving high resistance to wear combined with a need for good machinability.

Discussion following the presentation of the paper called attention to the unusual nature of the irons selected for study. The authors replied that their study was an evaluation of the microstructure and that a base iron containing 10 per cent ferrite and a base iron containing 90 per cent ferrite were selected to obtain desired microstructures.

Temper Embrittlement in Nodular Cast Irons, G. N. J. Gilbert, British Cast Iron Research Association, Birmingham, England. Mr. Gilbert has observed that temper embrittlement in ferritic iron induced by quenching at 842 F of an iron previously slow cooled from above 1202 F can be removed by quenching from 1202 F. The susceptibility of nodular and malleable cast irons to temper embrittlement is increased by additions of phosphorus and silicon, but phosphorus is much more effective than silicon, according to the author. Mr. Gilbert also found that the addition of molybdenum to an iron susceptible to temper embrittlement will inhibit embrittlement of the iron.

Ductile Iron—Alloyed and Normalized, C. R. Isleib and R. E. Savage, International Nickel Co., Inc., Bayonne, N. J. The authors reported that mechanical properties were determined for four types of ductile iron: (a) unalloyed; (b) nickel containing; (c) nickel-molybdenum containing; and (d) nickel-molybdenum-vanadium containing. Sections sizes varied from one-half to six inches. Three conditions of heat treatment were investigated: (a) as cast; (b) normalized; and (c) normalized and tempered.

Heat Transfer

Some Generalized Solidification Studies, V. Paschkis and J. W. Hlinka, Columbia University, New York. Mr. Paschkis stated the two purposes of the investigation were: (1) to find the pouring temperature, the temperature of the surface of contact between casting and mold interface, the fusion temperature and the temperature distribution in a casting which is infinitely long; (2) to establish the class of casting problems adequately presented by dimensionless parameters. Temperatures in parameters are expressed not in degrees but as fractions of a maximum temperature. In the discussion it was

How Was The Show?

▪ At the 1st Engineered Castings Show, **Joe W. Beckham,** design engineer, Texas Foundries, Lufkin, Texas, told MODERN CASTINGS that, "This Show is a good medium to demonstrate foundry ability to purchasing agents, chief engineers and chief inspectors. These are the men whom I believe control casting buying and must be convinced. This event creates a wonderful opportunity to invite potential customers to see what you can do. Exhibitors seem to be displaying their most complex castings which are competing primarily with weldments. I suggest they not neglect showing some of the simpler shapes that are giving forgings a run-for-their-money. Because of the economic limitations on how far castings can be shipped and remain competitive, I would like to suggest that a number of regional shows of this type be planned."

How Was The Show?

■ At the 1st Engineered Castings Show, **D. T. Bucchioni,** manager of buying, Military Products Div. International Business Machines Corp., Owego, N.Y., told MODERN CASTINGS, "We have purchased considerable quantities of aluminum castings and recently magnesium. Four of our men are here to see the light metal castings for new ideas on design. A very educational show from our view point.

brought out that the studies are theoretical but Mr. Paschkis stated that practical value could be derived from the studies by making the information better understood by foundrymen.

Temperature Drop in Pouring Ladles, V. Paschkis and J. W. Hlinka, Columbia University, New York. Part 2 of AFS Research Progress Report. Mr. Paschkis explained that this was an investigation of temperature drop in pouring ladles with the metal in strong agitation. The previous report covered metal without agitation. The studies were made using steel and gray iron. Variables introduced included size of lining, size of ladle, presence or absence of covers, and varying of preheat temperature. Results showed that holding times for complete mixing are shorter because the heat of fusion is not being liberated and because complete mixing eliminates all thermal resistance within the melt. It was pointed out by Mr. Pashkis that the true temperature drop in ladles lies somewhere between the two reports. This was substantiated by several participants in the discussion period.

Transport of Feed Metal During Solidification of Tapered Steel Bars, E. J. Sullivan, C. M. Adams, and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass. The authors conducted experimental and theoretical studies of the padding requirements for cylindrical cast plain carbon steel bars. Convex parabolic distribution of metal for padding was found to produce castings in which, shrinkage, if any, was distributed uniformly over the length of the bars. Theoretical reasoning was presented indicating this form of padding should be more efficient than straight or concave taper. The investigation showed that pure metals require much less padding than steel because of their smooth liquid-solid interfaces.

Flow of Heat from Sand Castings by Conduction, Radiation and Convection, C. M. Adams, Massachusetts Institute of Technology, Cambridge, Mass. The author set forth some of the simpler and more important relationships governing the rate at which heat may leave the casting and enter the mold. Thermal analyses of both castings and molds as well as pour-out tests were used to determine solidification times of cast shapes used in the investigation. The author states that, given the appropriate thermal data, it is possible to calculate the rates and times of solidification for three simple shapes, the sphere, slab, and cylinder. Although these shapes are seldom encountered in practice, calculations clearly indicate the role of mold contour in heat conduction.

Light Metals

Expendable Graphite Molds for Production of Titanium Castings, A. L. Feild, Jr., E. I. Du Pont de Nemours & Co., Wilmington, Del. and R. E. Edelman, Frankford Arsenal, Philadelphia. Mr. Feild described a new technique and material for making expendable powdered graphite molds for casting titanium shapes. Expensive machining of molds from solid graphite has been eliminated by using a rammable mixture that is subsequently oven fired. Castings made in molds of this type show no evidence of contamination and have excellent physical properties. In response to an inquiry from the audience the speaker said that castings could be made in molds of this type with an accuracy of ±0.020 to 0.030 in. in.

Mechanical Properties of Cast Titanium-Iron and Titanium-Aluminum-Iron Alloys, N. Hehner, H. W. Antes, and R. E. Edelman, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia. The speaker, Mr. Hehner, described the work involved in evaluating the as-cast tensile and impact properties of Ti-Fe and Ti-Al-Fe cast alloys. Tensile strengths as high as 147,000 psi were obtained in both alloy families. As the iron content increased the investigators found that tensile strength increased appreciably, ductility decreased, impact strength dropped off, and hardness went up.

Plans for the AFS research and educational programs were outlined by Technical Director S. C. Massari at Thursday's education session.

Rigging Design for a Typical High Strength, High Ductility Alloy Aluminum Casting, by M. C. Flemings, P. J. Norton, and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass. Professor Flemings described the use of chills to improve the physical properties of a 22 lb. sand cast high quality aluminum alloy strategic aircraft casting. By judicious chilling, the properties of this casting made in alloy 195 and in 356 showed remarkable improvement. Compared with minimum specifications, alloy 195 was improved 95 per cent in ultimate strength, 42 per cent in yield, and 1300 per cent in elongation. Using chills with alloy 356, these properties showed an improvement over the

Light metals luncheon: W. E. Sicha, J. G. Metzoff, E. V. Blackmun, D. L. LaVelle, speakers F. H. Mason, S. B. Curtis.

Brass and Bronze breakfast head table includes, reading from the left, R. B. Fischer, C. T. Koehler, J. E. Gotheridge, H. L. Smith, H. C. Ahl, R. J. Keeley, R. A. Colton, H. M. St. John, and William Romanoff.

minimum of 89,63, and 800 per cent respectively.

General Statement of the Art of Titanium Casting, G. H. Schippereit, R. M. Lang, and J. G. Kura, Battelle Memorial Institute, Columbus, Ohio. Mr. Schippereit presented this paper as a review of the progress made in the field since 1946. The advantages of the metal and the problems to be solved in developing a commercial casting method were detailed. The principal research must be done on furnaces and on molding materials, according to the authors.

Although Mr. Schippereit had remarked that a commercial casting process was on the horizon, but not yet available, a member of the audience noted that some plants are now taking orders for titanium castings.

How Was The Show?

▪ At the 1st Engineered Castings Show, **Frank J. Ferrante,** project engineer, Avco Mfg. Co., Cincinnati, said that "My group deals with electronic and radar components, several of the precision casting exhibits were of interest for us. I'm recommending that more of our personnel attend. It gives a good idea of the possibilities of castings.

Performance of Chills on High Strength, High Ductility Sand-Mold Castings of Various Section Thicknesses, M. C. Flemings, P. J. Norton, and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass. Mr. Flemings described the benefits to be derived by casting alloy 195 and 356 against chills. Chill casting of alloy 356 resulted in a 70 per cent improvement in ultimate strength, 40 per cent greater yield strength, and seven-fold increase in ductility. In the discussion following the presentation the importance of this improved ductility obtained by chilling was emphasized as a means of redistributing high stress concentrations.

Intricate Small Diameter Coring for Aluminum and Magnesium Castings, R. F. Dalton, Howard Foundry Co., Chicago. In his talk, Mr. Dalton described a new technique for forming small, intricately shaped passageways in aluminum and magnesium alloy sand castings by utilizing pre-formed metal tubing sheathed in a flexible refractory sleeve. By using chemicals both the tube and sleeve are removed from the casting after it has solidified.

Aging Practice for Aluminum Alloy HP-356, A. B. DeRoss, Kaiser Aluminum & Chemical Sales, Inc., Chicago. By limiting the iron content to a maximum of 0.15 per cent, remarkably improved physical properties for aluminum alloy 356 have been obtained, according to the speaker Mr. DeRoss. Improved ductility, tensile and yield strength result when this alloy is given a more complete artificial aging by holding longer periods at higher temperatures. In reply to queries from the floor, the speaker explained that the data presented in the paper were derived from test bars and that the machinability of the alloy was good, after heat treatment.

Exect of Small Tin and Cadmium Additions to Binary Aluminum-Rich-Copper Alloys, by H. V. Sulinski, R. C. Harris, and S. Lipson, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia. The speaker, Mr. Harris, related the benefits to be derived from small additions of tin and cadmium to aluminum alloy 195. By lowering copper content to 3 per cent, and adding either 0.03-0.05 per cent tin or 0.05-0.10 per cent cadmium, properties of this alloy can be raised to 46,000 psi tensile strength, 40,000 psi yield strength, and 3 per cent elongation. Grain refining with titanium further improves these properties.

Light Metals Round Table Luncheon

Presiding at the session was D. L. LaVelle, Kaiser Aluminum & Chemical Sales, Inc., Chicago, and E. V. Blackmun, Aluminum Co. of America, Pittsburgh, Pa. Panel members were Fred Mason, Chrysler Corp., Detroit, and C. M. Curtis, Maytag Co., Newton, Iowa. Mr. Mason said that light metals have made rapid strides because of their ability to be dimensionally accurate and lend themselves to automation. However, he said, light metals are not fully meeting the demands of industry. Further developments are needed, Mr. Mason stated, in higher machining rates, better dimensional control, and a trend away from higher injection pressures as a cure-all for production problems. Mr. Curtis listed 12 advantages of light metals from the viewpoint of an appliance manufacturer.

How Was The Show?

▪ At the 1st Engineered Castings Show, **W. Guy Bagley,** manager pig iron sales, Woodward Iron Co., Woodward, Ala., called it, "The best display of castings I have seen. It should become a regular show. In addition to showing what the industry is doing it also gives me a chance to contact many of my customers."

Fatigue Properties of Two Aluminum Die Casting Alloys, G. W. Stickley and J. L. Miller, Aluminum Company of America, New Kensington, Pa. The speaker related the results obtained in reversed bending and axial-stress fatigue tests of aluminum die casting alloys 218 and 380. No correlation was found between tensile strength and fatigue strength. Fatigue strength decreased with increasing temperature and is reduced by notches. The authors found that die cast cylinder heads of either alloy functioned satisfactorily under the repeated stress at elevated temperature characteristic of this application.

Corrosion of Aluminum Die Castings, D. L. Colwell and R. J. Kiss-
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ling, Apex Smelting Co., Cleveland. As the result of extensive corrosion tests, Mr. Colwell concluded that silicon alloys such as No. 43 (S5C) and No. 13 (S12A) have superior corrosion resistance. The silicon magnesium alloy No. 36 (SG100A) has inferior corrosion resistance and the common die casting alloy No. 39 (SC84A) has intermediate properties. Iron beyond 1.3 per cent in alloys should be avoided while zinc up to 2-1/2 per cent is not harmful to corrosion resistance.

Vacuum Die Casting Today & Tomorrow, D. Morgenstern, Nelmor Mfg. Co., Euclid, Ohio. The author, Mr. Morgenstern, described recently designed equipment that makes the vacuum process both economical and beneficial. Drastic reduction in wall sections without losing strength produces die castings made by this process competitive with stampings. Formerly unattainable clear durable anodized finishes can be put on vacuum die cast aluminum alloys. In the discussion that followed, further advantage mentioned included the ability to bake enamel finishes at higher temperatures because blistering problem was eliminated.

Automatic Metering of Magnesium for Cold Chamber Die Casting, F. L. Burkett and F. C. Bennett, The Dow Chemical Co., Midland, Mich. With the aid of a motion picture, Mr. Burkett explained the design and operation of the automatic metering mechanism developed for cold chamber die casting of magnesium. Development of this equipment has led to increased casting rates, improved casting quality, reduced operator fatigue, and shot sizes larger than possible with conventional hand ladling operation.

Effect of Nitrogen and Vacuum Degassing on Properties of a Cast Aluminum-Silicon-Magnesium Alloy (Type 356), R. K. Owens, H. W. Antes, and R. E. Edelman, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia. The speaker, Mr. Antes, explained that in their work at the Arsenal more

hydrogen was removed from molten alloy 356 by degassing with nitrogen than with vacuum treating for the same period of time. Tensile properties of the alloy were the same regardless of which degassing technique was used. Strength of virgin metal heats was relatively uneffected by the first one per cent of voids.

Controlled Gas Content in Foundry Work, E. Scheuer, International Alloys, Ltd., Haydon Hill, Aylesbury, Bucks, England. This paper was presented by D. L. Colwell, Apex Smelting Co., Cleveland. The author pointed out the advantages of controlled gas content in alloys as a means of alleviating tendencies for gross shrinkage defects in areas difficult to adequately feed. A shrinkage die test was developed to reproduce closely the shrinkage defects found in permanent mold casting. By controlling gas content the author was able to control shrinkage behavior in permanent molds when casting aluminum alloys with long freezing range but not with those having short ranges.

Hot Tearing of Magnesium Casting Alloys, R. A. Dodd, University of Pennsylvania, Philadelphia, W. A. Pollard, and J. W. Meier, Department of Mines and Technical Surveys, Ottawa, Canada. Mr. Dodd described the testing of over 17 different magnesium-base alloys to determine their susceptibility to hot tearing. This research confirmed that magnesium alloys are markedly less hot-short than aluminum-base alloys of similar composition. Most alloys in the Mg-Al-Zn system are comparatively free from hot-shortness. The Mg-Zn-Zr and Mg-Zn-Th-Zr systems are most prone to cracking.

Education

Chapter Educational Activities, E. J. Romans, National Malleable & Steel Castings Co., Cleveland. Mr. Romans stressed the importance of educational activities throughout the foundry industry. He outlined the importance of vocational guidance for high school students and the necessity of attracting college-trained men to foundries.

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Foundry Instructors Seminar, W. H. Ruten, Brooklyn Polytechnic Institute, Brooklyn, N. Y. Mr. Ruten said that the success of the first Seminar held in 1946 at Michigan State University, East Lansing, Mich., led to the scheduling of the second Seminar held June 20-22, also at Michigan State University. The Seminar program Ruter said, was to feature actual demonstrations of the application of epoxy resin patterns and the CO_2 process designed for use in school laboratories.

AFS Training & Research Institute, S. C. Massari, American Foundrymen's Society, Des Plaines, Ill. Mr. Massari described the AFS Training and Research Institute as a program which would help in answering the problems of the foundry industry in supplying the line supervision necessary for increasing technical processes and production methods. The courses will be of varying lengths but basically short-term courses that practicing foundrymen will be able to attend without a loss of considerable time at their respective plants. Starting this summer, courses will be held at Rackham Memorial, Detroit, Marquette University, Milwaukee, and University of Illinois, Navy Pier, Chicago. These courses will continue in such a manner until facilities are erected to house the Institute program.

Industrial Engineering

An Appeal to Foundry Executives, J. A. Wagner, Wagner Malleable Iron Co., Decatur, Ill. Modernization of cost and pricing methods are as essential to foundry operations as are production line improvements, Mr. Wagner stated. Competition from within the industry as well as from other forms of fabrication make it essential that the realistic foundry executive constantly review his cost and pricing policies, the speaker emphasized. An essential part of the cost program is an operating budget which will form the basis for a cost-finding budget.

Use of Memomotion in Setting Foundry Standards, L. L. Randolph, American Steel Foundries, Granite City, Ill. Mr. Randolph described the application of standards using a motion picture camera to record the movements of each worker. Filming of the activities provides more detail than using a stop watch and in addition provides a permanent record. A step-by-step procedure was given for the filming of a 23-man team producing side frame molds. This included relations with the union, the utilization of time-study men, and the equipment used.

Improving Foundry Layout, R. B. Sinclair, Meehanite Metal Corp., New Rochelle, N. Y. Through the use of slides Mr. Sinclair demonstrated how to plan plant layout to reduce labor requirements and speed production, to minimize materials handling costs, to keep operations flexible, and to allow for plant expansion and growth. Three-dimensional models, although they entail higher costs, will easily pay for themselves through a more accurate layout of the plant, the speaker stated.

Materials Handling in the Foundry, R. A. Petersen, Pangborn Corp., Hagerstown, Md. Factors to consider in purchasing or re-designing equipment for improved materials handling in foundries were discussed by Mr. Peterson. Using flow charts and recapitulation sheets, the speaker listed typical foundry handling problems and suggested several ways for more efficient handling. Each of the solutions were considered and the most appropriate one selected after considering such factors as cost, availability, and possible labor saving benefits. Movies were shown to demonstrate how materials handling methods had been installed in foundries. In the discussion it was pointed out that many minor changes in existing facilities can be made to achieve more efficient operations.

How Was The Show?

▪ At the 1st Engineered Castings Show, **William T. Bond,** producibility engineer, Martin Denver, Denver, Colo., told MODERN CASTINGS that "This show has acted as a bridge that closes the void between the castings users and producers. It has opened my eyes to many new avenues of uses for castings. As a result of coming here to Cincinnati, castings will receive more serious consideration in my future aircraft design activities."

foundry trade news

Federal Foundry Supply Co. . . Cleveland producer of foundry supplies, core blowers, and bentonite has been sold to Archer-Daniels-Midland Co., Minneapolis, subject to the approval of the Federal Trade Commission. Warner B. Bishop, Jr., vice-president of Archer-Daniels-Midland foundry products division stated that it is his firm's plan to continue operation of all departments of the Federal Foundry business without change or interruption.

Bethlehem Foundry & Machine Co. . . Bethlehem, Pa., plant is now controlled by Superior Tool & Die Co., Detroit, which has acquired over 71 per cent of the common stock. The plant will be operated as a subsidiary of Superior Tool.

St. Louis Steel Castings, Inc. . . has declared a quarterly dividend of 15 cents on its common stock payable in July.

Arwood Precision Casting Corp. . . New York firm has expanded its West Coast operations by purchasing Duncan-Rohne Co. and Malco Metal Products Co., both of North Hollywood, Calif. Duncan-Rohne produces non-ferrous investment castings and Malco specializes in machining castings.

Birdsboro Steel Foundry and Machine Co. . . Birdsboro, Pa., firm reports net income of over $168,000 on sales of over $4,200,000 during the first quarter of 1957.

Badger Malleable & Mfg. Co. . . South Milwaukee, Wis., plant has been sold to Mueller Industries, Inc., of Aurora, Ill. Mueller Industries now operates five foundries in Illinois, Indiana, and Wisconsin. The firm reported sales of $20,000,000 last year.

Malleable Research and Development Foundation . . has officially opened its offices in Granville, Ohio.

American Steel Foundries . . has announced that its Griffin Wheel Co. subsidiary has started manufacture of EQS steel railroad car wheels at Colton, Calif.

Mansfield Brass & Aluminum Corp. . . firm operating jobbing foundries at Mansfield and New Washington, Ohio, has elected a new board of directors. Directors are: D. W. Frease, president of Empire Steel Corp.; J. H. Gongwer; C. M. Zust, president of Cornwell Quality Tool Co. and Charles M. Zust Co.; Mrs. Barbara R. Bierly; J. R. Bierly, chairman.

Electric Steel Foundry Co. . . Portland, Ore., firm has announced the four winners of its first scholarship award program. Winners are: R. C. Petrone, Portland, Ore.; S. F. Di Zio, Portland, Ore.; Jane Berger, Mount Carmel, Pa.; and G. A. Pearson, student in electrical engineering at Oregon State College.

American Lithium Institute, Inc. . . has moved to new quarters at 32 Nassau St., Princeton, N. J.

Werner G. Smith, Inc. . . has formed a chemical division which will be located in Cleveland and will manufacture new products which will expand the company's present line of sperm whale oils, fish oils, and core oils.

American MonoRail Co. . . Cleveland firm plans an 85,000 sq ft addition to its plant at West 150th St. and will consolidate all manufacturing operations in this one location.

Hansell-Elcock Co., Chicago, recently held open house for some 250 guests representing 100 customer firms. Plant tours covered the complete foundry operation and exhibits were arranged to explain the processes to the visiting engineers and purchasing agents.

local foundry news

Twin City's Educational Program Treats Present and Future Needs

Chapter conducts seminar and assists in writing of manual

An aggressive, practical education program by the Twin City Chapter has made 1957 one of the chapter's most progressive years. During February, four seminars on basic foundry practices were held. Recently completed was a teaching guide for foundry instruction in the Minnesota public school system.

More than 100 foundrymen attended each of the four sessions held at the University of Minnesota, Minneapolis. The first meeting dealt with gray iron foundry practice and was conducted by Prof. Fulton Holtby, University of Minnesota. At the next session, D. W. Schuler, American Hoist & Derrick Co., St. Paul, Minn., discussed steel foundry practice. M. P. Schroeder, C. W. Olson Mfg. Co., Minneapolis, spoke on non-ferrous problems and practices at the third meeting and at the final session malleable iron techniques were covered by D. B. Fulton, Northern Malleable Iron Co., St. Paul, Minn.

Summaries of the four discussions have been prepared and mailed to those attending. The idea for the seminars was originally suggested by John J. Uppgren, Northern Ordnance Co., Minneapolis. He was assisted by J. D. Johnson, J. David Johnson Co., Anoka, Minn., A. D. Moll, Minneapolis Electric Steel Castings Co., Minneapolis, and R. J. Mulligan, Archer-Daniels-Midland Co., Minneapolis.

A meeting between chapter members and Twin City educators at the first Foundry Instructors Seminar at Michigan State College, East Lansing, Mich., in 1956 prompted the compiling of a foundry instruction manual. Six foundrymen and seven high school and college trade instructors formed the committee preparing the instruction guide.

Contributors to the manual were: Fulton Holtby, University of Minnesota, Minneapolis; A. S. Cuthbert, Washington High School, St. Paul, Minn.; I. Johnson, Mankato State College, Mankato, Minn.; R. E. Larson, Minneapolis Vocational High School, Minneapolis; H. W. Teichroew, St. Paul Vocational School, St. Paul, Minn.; L. Turula, Central High School, Norwood, Minn.; H. Widdowson, University of Minnesota High School, Minneapolis; J. R. Entenmann, Northern Malleable Iron Co., St. Paul, Minn.; D. B. Fulton, Northern Malleable Iron Co., St. Paul, Minn.; Herbert Jacobsen, Gopher Pattern Works, Minneapolis; A. D. Moll, Minneapolis Electric Steel Castings Co., Minneapolis; and F. S. Ryan, St. Paul Brass Foundry Co., St. Paul, Minn.

These contributors were headed by R. M. Worthington, State of Minnesota Industrial Education, and M. P. Schroder, C. W. Olson Mfg. Co., Minneapolis.

Officers and directors were elected at the May meeting of the **Quad City Chapter**. Shown left to right are: J. H. Coats, A. P. Green Firebrick Co., Moline, Ill., elected as a three-year director; E. F. Peterson, Martin Engineering Co., Neponset, Ill., chapter vice-chairman; W. A. Salzman, International Harvester Co., Rock Island, Ill., a three-year director; M. H. Horton, Deere & Co., Moline, Ill., chapter chairman; G. P. Barrett, Fairbanks, Morse & Co., Moline, Ill., three-year director; and Medie Hakeman, Deere & Co., East Moline, Ill., chapter secretary-treasurer.

Oregon Chapter's outgoing chairman, Fred M. Menzel, Rich Mfg. Co., Portland, Ore., shown on right, congratulates the new chairman, Harry K. McAllister, Western Foundry Co., Portland, Ore.

Central Ohio Chapter members at the April meeting heard M. J. Kellner, Trafford Foundry Div., Westinghouse Corp., Trafford, Pa., speak on *"A Practical Approach to a Profitable Foundry."* Among the topics Mr. Kellner discussed were labor relations, safety, quality control, demands of engineers in the foundry, purchasers, sales, and standardization of department organization.

Northwestern Pennsylvania Chapter members visited in April the Chicago Pneumatic Tool Co., Franklin, Pa. In the evening D. E. Krause, technical director, Gray Iron Research Institute, photo, spoke on *"Hot Blast Cupola Operation and Slag Compositions."*
MILWAUKEE CHAPLET PHOTO

Blast Cleaning at Michiana

Progress in blast cleaning from its inception in the casting industry to present-day automation was explained to the Michiana Chapter by Frank Pedrotty, Wheelabrator Corp., Mishawaka, Ind. Other activities included the election of officers and the presentation of apprentice contest awards. Clarence Bowman, Dalton Foundries, Inc., Warsaw, Ind., chairman of the education committee made the awards. First and second place winners were: wood pattern, James Tim and J. P. Wuthrich of City Pattern & Foundry Co., South Bend, Ind.; non-ferrous, Donald Kovatch and Charles Graham, Torrington Co., South Bend, Ind.

Metropolitan Chapter Hears Talk on Atomic Powerplant

Atomic power's peace time applications were outlined at the April meeting of the Metropolitan Chapter. Charles E. Hoppin, Consolidated Edison Co., in an illustrated lecture discussed Consolidated's generating plant at Indian Point, N. Y. The speaker demonstrated the radioactivity of various ores and said that although the cost of usable electrical energy was lower from conventional fuels than fissionable material, increased technology was expected to reverse the situation.

Practical courses, lectures, and plant visits formed the basis for a practical foundry educational program held once-a-week for 16 weeks by the **Philadelphia Chapter.** The course included green sand molding with various types of patterns, coremaking, and the melting, pouring, and handling of metal. Students prepared the sand, made the molds, and poured the metal. Classes were held at Dobbins Vocational School which is equipped with both cupolas and gas-fired furnaces. Practical courses were supplemented by lectures from foundrymen and visits to Olney Foundry, Link-Belt Co., and Dodge Steel Co. Chairman of the chapter education committee is E. A. Zebb, Dodge Steel Co.; assistant chairman is E. X. Enderlein, H. G. Enderlein Co. Photo shows R. C. Stokes, Philadelphia Brass & Bronze Co., Philadelphia, instructing class on shell molding.

Honor Old-Timers, Past Presidents at Northeastern Ohio Meeting

Old-timers and past presidents were honored at the May meeting of the Northeastern Ohio Chapter meeting at the Tudor Arms Hotel, Cleveland. Attending were 50 old-timers with more than 40 years in the foundry industry as well as 14 of the 17 living former chapter presidents. E. C. Jeter, Ford Motor Co., Cleveland. presented certificates to the old-timers.

Transistor radios were awarded to winners of the membership contest, Thomas Kuhlman, Superior Foundry Inc., Cleveland, and Charles Jelinek, Ford Motor Co., Cleveland.

Ductile Iron Talk at Timberline

Ductile iron and closer cooperation between the Timberline Chapter and the University of Colorado were the subjects covered at the May meeting held at Hotel Oxford, Denver, Colo. H. W. Northrup, International Nickel Co., presented an illustrated ductile iron lecture and Patrick Gibbons, University of Colorado, Boulder, Colo. discussed the advantages of chapter-university relationships.

Magnesium Talk at Washington

Magnesium foundry practices were explained to the Washington Chapter members in April by M. E. Brooks, Dow Chemical Co., Bay City, Mich.

N.F.F.S. banquet—G. L. Brunsman; M. E. Nevins, Wisconsin Centrifugal Foundry, Inc., Waukesha, Wis.; C. J. Egetter, Crown Brass Mfg. Co., Alhambra, Calif.; Fred Smith, speaker; Robert Langsenkamp, Langsenkamp-Wheeler Brass Works, Indianapolis; E. J. Metzger, Multi-Cast Corp., Wauseon, Ohio; L. H. Durdin, Dixie Bronze Co., Birmingham, Ala.; P. E. Lankford, East Birmingham Bronze Foundry Co., Birmingham, Ala.; W. L. Leopold, Northern Bronze Corp., Philadelphia; R. T. Stanton, Aluminum Foundry, Cincinnati; H. F. Scobie, N.F.F.S. executive secretary. Officers elected at the May meeting of the Non-Ferrous Founders' Society are, president, C. J. Egetter; 1st vice-president, Phillip E. Lankford; 2nd vice-president, M. E. Nevins; Herbert F. Scobie, executive secretary, continues as secretary-treasurer.

Industrial Safety Explained to Metropolitan Brass Group

Why industrial safety visits are made and the basis for recommendations were explained at the May meeting of the Metropolitan Brass Founders Association. The speaker was Joseph Marchetti, of the New York State Division of Industrial Safety Service. His talk was followed by a question and answer session.

Texas Chapter held its 1st Annual Past Chairmen's dinner during May. Elmore C. Brown, Whiting Corp., Houston, Texas, incoming chairman, shown on left, receives gavel from past chairman, W. A. Bearden, M. A. Bell, Co., Houston, Texas.

Ontario's Ladies Night

More than 250 persons attended the 4th annual Ladies Night of the Ontario Chapter held at the Royal Connaught Hotel, Hamilton, Canada. Entertainment was arranged by Don Cole, Canadian Foundry Supplies & Equipment, Ltd.

San Antonio Sees Films

Films were shown at the May meeting of the San Antonio section, Texas Chapter, held at Alamo Iron Works, San Antonio, Texas. The chapter voted to discontinue meetings during June, July, and August.

Chesapeake Chapter combined its May meeting with plant visits to T. B. Woods & Son Co., and Chambersburg Engineering Co., located in Chambersburg, Pa. Election of officers took place at the meeting. Shown in front of a large casting at Chambersburg Engineering Co. are: George H. Martin, Chambersburg Engineering Co.; H. M. Witmyer, Jr., Foundry Service & Supply Co., Baltimore, Md.; W. S. Crisp, Gibson-Kirk Co., Baltimore, Md.; D. A. Roemer, Franklin-Balmer Corp., Baltimore, Md.; W. O. Becker, Atlantic Abrasive Co., Baltimore, Md.; and C. Douglas Galloway, Chambersburg Engineering Co.

dietrich's corner

by h. f. dietrich

I know that calling "loafing" a lost art will startle the time-study man who has just finished a job analysis sheet on Joe, the average workman. It will also surprise the office force if the Boss has just returned from the Bahamas. But I still insist, loafing is a lost art.

Let's consider Joe, the average workman who has just had a stop watch held on him. All day, day after day, Joe has been working to a rhythm. Suddenly, a time-study man appears on the job, and Joe is compelled to think of each movement. Both Joe and the time-study man know that if he produces at incentive speed, no one will believe the stop watch. If the job is slowed down too much, Joe will be accused of loafing with conclusive evidence to support the accusation.

To satisfy the requirements of average effort, Joe must break his rhythm. His mind must follow each movement of his body. This puts Joe under a mental strain that is more fatiguing than working at a rate for which his body has been trained. This isn't loafing; it is hard work!

Now, let's follow the Boss to the Bahamas. He lives in the Middle West where a lifeboat is a curio. His business is in a condition that will allow him to take two weeks off without danger of the hired help taking him to the cleaners. When he was young, and couldn't afford it, he dreamed of basking on the beach of some far off island. This is his chance.

He doesn't have time to read all of the travel folders, so he calls a travel agency to plan the trip. An eastern customer is about ripe for an order that will keep the Boss solvent; he places a phone call and invites the customer and wife to join him. Now the trip can be listed as a business expense for bookkeeping purposes.

Of course, with friends along, the Boss will have to pack his tux, his wife will need a new wardrobe, and reservations will have to be made at flying fields, hotels, and travel agencies. Every day, every evening will be arranged to make the most of the available time. With naive envy, the office force watches his departure.

While he is gone the scrap iron market breaks. Does this catch the Boss with his reserves down? Not a bit! He has been reading the market reports, and he wires the P. A. to order twenty cars of No. 1 foundry scrap.

For the edification of the overworked secretary who has been spending Wednesday afternoon filing her fingernails, this guy isn't loafing! He has taken his business along in his hip pocket.

The most satisfactory feeling of loafing within my memory was when, as a small boy, I lay spread-eagle in a pile of freshly raked, musty leaves. Above, the stars, undimmed by the glare of street lights, shown through a smoky haze made pungent with burning leaves. Every now and then, a chestnut thrown into the fire would explode sending a small shower of red sparks into the branches.

Without turning my head, I could learn from the orchestral night sounds just what was happening for a block in either direction. A man approaching from any right made a rhythmic sound on the board side-walk. When he passed the Delmar's place, a loose board clattered as it fell back into place. The jingle of loose trace links and the ascending and decending squeel of a loose rimmed wheel told me that the O'Conners were on their way home, long before a vagrant breeze brought the aroma of a hot kerosene lantern mixed with the odor of sweating horses. Time is a relative dimension at best. In this setting it could be disregarded.

We no longer have time for this totally relaxed—physical and mental—type of loafing. Economically and socially we are forced to conform to an accepted pattern of life. Loafing has indeed become a lost art.

MORE FACTS on all products, literature, and services shown in the advertisements and listed in Products & Processes and in For the Asking can be obtained by using the handy Reader Service cards, pages 7-8.

Castings Council Advocates Restoring B.S.D.A. Funds

■ Concern over possible curtailment of the Business and Defense Services Administration of the U.S. Department of Commerce through cuts in the federal budget was expressed at the meeting of the National Castings Council meeting in Chicago during May. The council is composed of 11 societies and associations in the foundry and allied industries.

By unanimous vote the council representatives sent the following telegram to Senator S. L. Holland, chairman of the Senate sub-committee on appropriations for the Department of Defense.

"The National Castings Council respectfully urges restitution of funds for continuation of industry divisions of Business and Defense Services Administration as part of U. S. Department of Commerce appropriations. Our experience with allocations, priorities and other controls during World War II and Korean emergency clearly illustrated the need for maintaining a central business agency in Washington equipped with necessary staff and experience for mobilization planning. This staff and the required planning cannot be developed overnight and therefore ought to be kept in being in face of indicated accelerated mobilization requirements. As businessmen we favor economy but believe the necessary functions of the industry divisions must be carried on and cannot be done any more economically or as efficiently any other way. Transfer of the functions of the industry divisions to other government agencies will result in confusion and the cost will necessarily be as great or greater. The 11 member organizations of the Council represent all segments of the foundry industry including ferrous and non-ferrous castings producers and equipment and supplies manufacturers. More than 6000 business enterprises make up the membership of the Council organizations. We will be happy to provide further details concerning the industry's views if requested."

'Scuse, Please

In the March issue of MODERN CASTINGS the Foundry Facts department was a chart entitled "Quality Control/Nonferrous Castings." Credit for this chart was given to Sam Tour & Co., Inc. but the company address of 44 Trinity Place, New York 6, was inadvertantly omitted.

Specifications of magnesium casting alloys and the chemical composition, physical properties, and characteristics of these alloys have been tabulated by Dow Chemical Co. in a new publication, *"Room and Elevated Temperature Properties of Magnesium Casting Alloys."*

These tables are reprinted here as well as the following condensed remarks on room and elevated temperature properties.

General Considerations

Except in elevated temperature applications, the few reported service failures of magnesium castings are of fatigue origin and result from inadequate design allowance for stress concentrations. A choice of an elevated temperature alloy cannot be made on the basis of operating temperature alone. Stresses and times of operations should be known for both peak and normal conditions.

The alloy composition suggested for a particular application may vary between foundries because the design factors are far more important than metallurgical factors in determining serviceability of some cast magnesium parts.

The magnesium alloys systems of commercial importance are magnesium-aluminum-zinc, magnesium-zinc-zirconium, magnesium-rare earth metals-zirconium, and the magnesium-thorium-zirconium alloys.

Mg-Al-Zn

AZ92A, AZ63A, AZ91C, and AZ81A are the principle Mg-Al-Zn sand casting alloys. AZ92A is used where high yield strength with moderate elongation is required, or where pressure tightness is important. AZ63A and AZ91C are used where greater elongation and toughness are required. Because of its porosity tendency and other foundry defects, AZ91C-T6 and AZ81A-T4 are suggested as replacements for AZ63A in certain applications.

The Mg-Al-Zn alloy system provides stable properties up to around 200 F and often gives satisfactory service up to 350 F if operating stresses are not too high. The particular alloy and heat treatment desired depends on the application.

Mg-Zn-Zr

In the Mg-Zn-Zr system, ZK51A (the British Z5Z) is reported to have interesting mechanical properties but has not been proven in service in the United State ZK51A has high ductility plus high yield strength with only an artificial aging treatment (T5). Tests show this alloy to have a fatigue strength at least equal to the Mg-Al-Zn alloys. ZK51A is suggested for simple, high stressed parts of uniform cross section. Acceptance of this alloy is retarded by the higher cost of the alloy as compared with the Mg-Al-Zn alloys and such foundry problems as (1) poor fluidity, (2) dross formation, (3) visual shrinkage defects, (4) incidence

TABLE 1. SPECIFICATIONS OF MAGNESIUM CASTING ALLOYS

Alloy	British	MIL	AMS	SAE	ASTM	Federal	Remarks
Sand Castings							
AZ63A			4420(1)	50	B80-56T	QQ-M-56	QQ-M-56A (proposed)
AZ81A					B80-56T		QQ-M-56A (proposed)
AZ91C				504	B80-56T	QQ-M-56	QQ-M-56A (proposed)
AZ92A			4434	500	B80-56T	QQ-M-56	QQ-M-56A (proposed)
EK30A					B80-56T		
EK41A			4441(2)		B80-56T		
EZ33A	ZRE1	MIL-M-9433	4442		B80-56T		QQ-M-56A (proposed)
HK31A			Proposed		B80-56T		QQ-M-56A (proposed)
HZ32A(3)	ZT1		Proposed		B80-56T		QQ-M-56A (proposed)
ZE41A	RZ5				B80-56T		
ZH62A(3)	TZ6				B80-56T		QQ-M-56A (proposed)
ZK51A	Z5Z	MIL-M-8213	4443		B80-56T		
Permanent Mold Castings							
AM100A				502	B199-54T	QQ-M-55	
AZ92A			4484	503	B199-54T	QQ-M-55	QQ-M-55a (proposed) (4)
Die Castings							
AZ91A			4490	501	B94-52	QQ-M-38	
AZ91B				501A	B94-52		

(1) AMS 4420—as cast, AMS 4422—heat treated, AMS 4424—heat treated and aged.
(2) AMS 4441 applies to EK41A-T6 (heat treated and aged); AMS 4440 applies to EK41A-T5 (as cast and aged).
(3) HZ32 and ZH62 are patented in the U.S.—HZ32 by U.S. Pat. No. 2604396, July, 1952, assigned to Magnesium Elektron Limited, and ZH62 by U.S. Pat. No. 2750288, June 12, 1956, also assigned to M.E.L. Dow is licensed to produce these alloys.
(4) The proposed spec. QQ-M-55a will cover EZ33A, AZ63A, AM100A, AZ91C, AZ81A and AZ92A as permanent mold casting alloys.

of microporosity, and (5) high cracking tendency.

Mg-Rare Earth Metal-Zr

The addition of rare earth metals to magnesium results in casting alloys for use at temperatures between 350 and 500 F. Use of these alloys usually provides a lighter design than is possible with the Mg-Al-Zn alloys. This is true particularly where high operating stresses require wall-thickness greater than the minimum that can be cast.

Common alloys in this area are EK30A, EK41A, and EZ33A.

Mg-Th-Zr

Mg-Th-Zr alloys (with and without Zn) are intended primarily for elevated temperature applications 400 F and above where properties superior to those of the Mg-rare earth metals-Zr system are required. Castings of this alloy group are useable to 650-700 F.

TABLE 2. CHEMICAL COMPOSITION, PHYSICAL PROPERTIES AND CHARACTERISTICS

Alloy	Temper	Al	Zn	RE**	Zr	Mn (Min.)	Th	Pressure Tightness	Porosity Tendency	Resistance to Corrosion	Electro Plating	Weld-ability	Specific Gravity	Density lb./cu. in.	Thermal Conductivity at 68F cgs Unit	Electrical Resistivity Microhm cm. at 68F	Coefficient of Thermal Expansion 212-570F
Sand Casting Alloys																	
AZ63A	-T4	6.0	3.0	-	-	0.15	-	C*	C	B	A	C	1.83	0.066	0.13	13.9	0.0000145
AZ81A	-T4	7.6	0.7	-	-	0.13	-	B	B	B	B	B	1.80	0.065	-	15.6	0.0000145
AZ91C	-T4	8.7	0.7	-	-	0.13	-	B	B	B	B	B	1.81	0.066	0.11	16.6	0.0000145
	-T6	8.7	0.7	-	-	0.13	-	-	-	-	-	-	-	-	0.13	13.3	0.0000145
AZ92A	-T6	9.0	2.0	-	-	0.10	-	B	B	B	B	B	1.82	0.066	0.14	12.2	0.0000145
EK30A	-T6	-	-	3.0	0.3	-	-	A	A	A	B	A	1.79	0.065	0.27	6.0	0.0000145
EK41A	-T5	-	-	4.0	0.6	-	-	A	A	A	B	A	1.81	0.066	0.24	7.0	0.0000145
	-T6	-	-	4.0	0.6	-	-	-	-	-	-	-	-	-	0.22	7.5	0.0000145
EZ33A	-T5	-	2.7	3.0	0.7	-	-	A	A	B	B	A	1.82	0.066	0.25	6.5	0.0000145
HK31A	-T6	-	-	-	0.7	-	3.0	A	A	A	-	A	1.79	0.065	0.22	7.2	0.0000145
HZ32A	-T5	-	2.1	-	0.7	-	3.0	A	A	B	-	A	1.83	0.066	0.25	6.5	0.0000145
ZE41A	-	-	4.2	1.2	0.7	-	-	A	A	B	-	B	1.84	-	-	-	0.0000145
ZH62A	-	-	5.7	-	0.7	-	1.8	A	A	B	-	B	1.88	-	-	-	0.0000145
ZK51A	-T5	-	4.6	-	0.7	-	-	B	B	A	B	C	1.82	0.066	0.20	-	0.0000145
Permanent Mold Alloys																	
AM100A	-T61	10.0	-	-	-	0.10	-	A	A	B	A	A	-	-	0.15	11.6	0.0000145
AZ92A	-	9.0	2.0	-	-	0.10	-	Same as for sand cast alloys									
Die Casting Alloys																	
AZ91A	F	9.0	0.7	-	-	0.13	-	A	A	A	A	No	1.81	0.066	0.11	-	0.0000145
AZ91B	F	9.0	0.7	-	-	0.13	-	A	A	A	A	No	1.81	0.066	0.11	-	0.0000145

*All letter ratings are relative. "A" represents the best rating.

**Rare Earths

Malleable Founders Discuss How to Improve Competitive Position

Continued research, aggressive marketing, and long range planning will retain malleable's position in the competitive metal market, executives and sales personnel were told at the 8th Market Development Conference, sponsored by the Malleable Founders' Society. The meeting was held in April at the Edgewater Beach Hotel.

R. W. Heine, associate professor, University of Wisconsin, Madison, Wis., in discussing the competitive situation of malleable iron stated, "Malleable and pearlitic malleable offer numerous advantages which should be attractive to many users of metals. Close control by heat treatment, rigidity and durability of ferrous alloys, good properties for a wide range of service conditions and economic production are combined in malleables to a greater degree than in other ferrous alloys."

Lester B. Knight, Lester B. Knight & Associates, Inc., Chicago, told the conference that future developments will still require the same basic principles of good business management and engineering selling as in the past. "The application may vary," he said, "but the principles will be there."

Byron L. Ertsgaard, Toro Mfg. Corp., Minneapolis, in discussing the relationship between design engineers and technical salesmen advised salesmen to "Know your customer, his product, his organization, his problems. Then take these factors together with the know-how of your company and give him a better product.

Other speakers on the program were: Fred Catlin, Magnaflux Corp., Chicago, *"Good Design Sells Castings;"* Edward B. Hill, Koehring Co., Milwaukee, *"The 30 Billion Dollar Road Building Program;"* Lowell D. Ryan, Malleable Founders' Society, *"Little Known Uses of Malleable Castings;"* J. R. Hawkinson, Northwestern University, Evanston, Ill., *"The Tenets of Good Salesmanship."*

Also on the program was a discussion of the society's brochure, *"Value Analysis,"* a progress report on a road machinery market survey and a film from Superior Steel & Malleable Castings Co., Benton Harbor, Mich.

MORE FACTS on all products, literature, and services shown in the advertisements and listed in Products & Processes and in For the Asking can be obtained by using the handy Reader Service cards, pages 7-8.

afs chapter meetings

JULY

Wisconsin . . **July 26** . . Tuckaway Country Club, Milwaukee . . *Annual Outing.*

AUGUST

Canton District . . **Aug. 3** . . Brookside Country Club, Barberton, Ohio . . *Annual Picnic and Golf Party.*

Chicago . . **Aug. 10** . . Nordic Hills Country Club, Itasca, Ill. . . *Annual Stag and Golf Outing.*

Texas . . **Aug. 23** . . Fredonia Hotel, Nacogdoches, Texas . . *Officers' and Directors' Meeting.*

GANDY DANCE

Well, the foreman brings a pattern
And he tells you good and clear,
"Put a riser in the center
And a runner over here."
So you holler at the shagger
And he cusses when you ask
For a follow board with trunnions
And a deep drag flask.

Then you set the flask and board
Where it's handy to the sand;
You order up your facing
And you squeeze it in your hand.
You tighten up your flask bolts
And you hit 'em with a sledge,
Then you clamp on the follow board,
Secure it with a wedge.

Then you drag out a riddle
From the bottom of the rack,
Put your facing in the middle
And your backing on the back;
You pick up your rammer
And you roll up your pants
And you do the molder's gandy dance.

Then you roll her over easy,
Cut the joint to a slope,
You shake on some parting
And you set on the cope,
Line up the slots and markers
And secure 'em with a pin,
Then you sprinkle on some facing
And you set the gaggers in.

Then you drag out a riddle
From the bottom of the rack,
Put your facing in the middle
And your backing on the back,
Then you pick up your rammer
And you roll up your pants
And you do the molder's gandy dance.

obituaries

J. Howard Morgan, president of Cedar Heights Clay Co., Oak Hill, Ohio, died May 16 of a heart attack while working at his desk.

An active AFS member, Mr. Morgan served as director and membership chairman of the Central Ohio Chapter since 1950. He was active in civic affairs and at the time of his death was president of Oak Hill Hospital.

Fred H. Lindahl, 71, died May 11. He had retired in 1943 as president of Henry L. Lindahl Machine and Foundry Co., Cicero, Ill., established by his father.

Emil H. Blattner, research engineer for Symington-Gould Corp., Depew, N. Y., with whom he was associated since 1920, died suddenly April 22.

Over 100 patents covering improvements in railway equipment devices had been issued to Mr. Blattner during his connection with Symington-Gould Corp.

Harry T. Paterson, 46, operational manager of the Harbor Island and Kure Beach Corrosion Test Stations of International Nickel Co., Inc., died suddenly May 27. He had been with International Nickel Co. since 1946 and prior to that was assistant manager and chief engineer at Ethyl-Dow Chemical Co.

J. Martin Duncan, former president of Detroit Steel Castings Co., with whom he was associated for more than 40 years, died May 3 of a heart attack.

U.S. Die Casting Growth Outlined at Paris Meeting

Continuing growth in the use of die castings in the United States was discussed by Clifford L. Anthony vice-president, American Die Casting Institute, at the 2nd International Pressure Die Casting Conference held in May at Paris, France. Mr. Anthony said that in 1956 more than $427,000,000 in die castings had been sold. An additional $250,000,000 represented the value of die, special tooling, electroplating, and sales and services from job-shop die casters.

He noted that 465 of the nearly 800 U.S. die casters are job shops.

the SHAPE of things

safety, hygiene, air pollution

by HERBERT J. WEBER

Jury Returns Malpractice Verdict of $250,000 Against Plant

ARE YOU LIABLE?

If you employ an industrial physician or nurse it would be well to consult a lawyer in order to determine your liability in the event of malpractice by either of them.

In the interest of better employee relations some companies have extended the scope of their medical department to include personal or nonoccupational medical care.

Employees are encouraged to present themselves and their families to the dispensary for vaccinations, cold shots, hay fever shots, diathermy treatments, and desensitizing injections for allergies having no relation to employment. Often the industrial nurse administers these treatments and sometimes visits the homes of pensioners for the same purpose.

But Watch Out!

The Workmen's Compensation Act is not a bar to an action by an employee for alleged malpractice. Here are some recent verdicts in cases involving medical treatment:

1) Wisconsin—$97,000 malpractice verdict
2) Texas – $100,000 malpractice verdict
3) Tennessee – $200,000 malpractice verdict
4) San Diego—$210,000 malpractice verdict
5) San Francisco—$250,000 malpractice verdict
6) Palo Alto—$290,000 malpractice verdict

Ordinarily the physician and nurse are considered independent contractors, but under certain circumstances they are employees of a given employer even though they have other private medical practice. If such be the case, the employer can become liable for both negligence of, or injury suffered by the physician or nurse.

Some Examples of Liability

1) An industrial nurse couldn't locate a steel sliver which had become imbedded in the hand of another employee, so the superintendent sent the worker to a neighborhood physician who handled minor injury cases for the plant. The physician trying to locate the sliver kept the employee's hand under the fluoroscope for about 20 minutes. The radiation burn suffered by the employee caused complete loss of the hand.

   The company, not the physician, was held liable. Skin grafts, numerous operations, lost wages, have cost the company $28,000 so far, and expenses haven't stopped yet.

2) A plaintiff was awarded $30,000 damages against Sunshine Biscuit Co. When she applied for employment she was required to submit to a physical examination and blood test. The physician employed by the company was negligent in withdrawing the blood specimen and a claw-like paralysis developed in the plaintiff's left hand.

   The court ruled that the physician acted as an employee and not as an independent contractor and therefore Sunshine Biscuit Co. was liable for his negligence.

3) A physician employed by Lockheed Aircraft Corp. to do pre-employment physical examinations, advised a prospective employee that it would be necessary to undergo an operation to correct a double hernia. The same physician performed the operation.

   The plaintiff later filed suit claiming that the operation was unnecessary and done in a negligent manner; that the physician in advising and performing the operation acted as an employee of Lockheed.

   The court found Lockheed liable for the acts of that physician. The physician need not necessarily be on your payroll in the strict sense.

Illegal Medical Practice

As previously stated, the industrial nurse is frequently called upon to give vaccinations, injections, etc. Do such treatments constitute the practice of medicine? That, of course, depends on the statute in a particular state. However, the Attorney General of Michigan in interpreting the Medical Practice Act held that such treatments by a nurse unless given under the immediate and direct supervision of a physician, are a violation of the Medical Practice Act.

It follows then that if an industrial nurse is administering such treatments without medical supervision, she is guilty of unlicensed practice of medicine and her employer will be liable at common law for any injury resulting from her acts. The limiting liability afforded by the workmen's Compensation Act will not apply.

The Remedy

Foundry management should carefully examine all of its medical policies and practices and obtain a legal opinion regarding the extent of liability in the event of injury resulting from the acts of a physician or nurse. The insurance carrier may be helpful. In any case, if you do not have malpractice insurance, it may be to your interest to buy some. One catastrophe could put you out of business!

Classified Advertising

For Sale, Help Wanted, Personals, Engineering Service, etc., set solid . . 25c per word, 30 words ($7.50) minimum, prepaid.

Positions Wanted . . 10c per word, 30 words ($3.00) minimum, prepaid. Box number, care of **Modern Castings,** counts as 10 additional words.

Display Classified . . Based on per-column width, per inch . . 1-time, $18.00; 6-time, $16.50 per insertion; 12-time, $15.00 per insertion; prepaid.

Help Wanted

MANUFACTURERS AGENT WANTED Several exclusive territories open to men with experience in melting practices. An opportunity to make real money selling the nationally advertised REVECON and REVERBALE Furnaces. Leads furnished. Submit details and other lines carried to . . . **INTERNATIONAL FOUNDRY SUPPLY CO. Box 1053, Reading, Pa.**

CERAMIC ENGINEER WANTED Ceramic Engineer to head complete ceramic laboratory. To supervise and run development tests. Preferably refractory specialties and fire brick experience. Some traveling for sales department will be necessary. **Box D-61, MODERN CASTINGS, Des Plaines, Ill.**

PLANT MANAGER New Steel Foundry under construction in Ontario has opening for man capable of handling complete supervision of all operations. In reply please submit data covering experience, age, and salary range. All Replies treated confidentially. **Box D-63, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

We need an experienced electric melting furnace melter-supervisor. Salary open. Contact Ivan Kerzner, New Jersey Metals Company, 712 Rockerfeller St., Elizabeth 2, New Jersey. ELIZABETH 4-6336

Positions Wanted

MANAGER Practical and progressive, with 37 years experience. Non-ferrous and ferrous production shops. Well versed in all departments, from the foundry to finished product. Excellent labor relations, bi-lingual (Spanish and English). Now employed. **Box D-62, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

For Sale

FURNACES FOR SALE

10 used Heat Treating Furnaces, and two 7-ton gantry cranes, good condition, priced to sell.

BAER STEEL PRODUCTS. INC.
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MOLDING MACHINE: Herman 6000# capacity, jolt-roll-draw in operating condition. asking $2,900.00 FOB Pottstown Machine Co., Pottstown, Pa. (Phone 37, H. H. Houston)

NON-FERROUS FOUNDRY

West of Milwaukee, Wis. Fireproof building, large parking area, room for expansion, making castings for many well-known firms, opportunity unlimited, well established, owner moving south. **Box No. 71, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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Sizes AFS-45 to flour

NORTHWEST OLIVINE CO.

Mount Vernon, Wash.

Wanted to Buy

Wanted to Buy 1945 issues of Foundry magazine, January-December. Will pay $1.00 each for uncut copies in good condition Box No. 70, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.

Now Where Was That?

■ You will have no trouble locating articles in back issues if you write for the free index to 1956 issues of Modern Castings.

advertisers and their agencies

This index is published as a convenience to the readers. While every care is taken to make it accurate MODERN CASTINGS assumes no responsibility for errors or omissions.

Best Radiographic Results Founded on Basic Layouts

This article is based on a chapter from RADIATION PROTECTION MANUAL *prepared by the Radiation Protection Committee of the American Foundrymen's Society to be published at a later date.*

■ Maximum return from radiographic inspection of castings starts with the basic foundry layout since later alterations of original plans are expensive. Compact exposure rooms are the cheapest but may entail later rebuilding. An "L" shaped room can save expense on door protection.

If the number of items to be x-rayed are numerous and the exposure times are short, a preparation room will almost double the production since setups can be performed while exposures are being made.

Choice of the unit will depend upon the alloy, casting thickness, and amount of work to be performed in a given time.

Size of the unit will determine the location and protection required. If the unit is isolated, only operating personnel and film storage need be protected. If located in a building having other employees, then protection must be adequate for all possible exposures.

The most common protective materials are lead, steel, and concrete. One inch of lead is about equivalent to four inches of steel or 12 inches of concrete. Combinations of these may be used to advantage.

With higher voltages (million or more) location over a basement should be avoided as a large percentage of exposures will be directed downward.

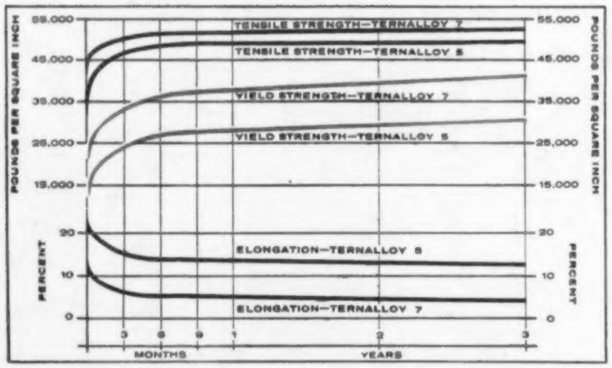
All doors leading to an exposure room should be protected by an interlock system so that no person can enter this area while the x-ray unit is in operation.

Monitoring equipment should be provided to detect radiation scatter. All possible areas must be covered. Due to the character of the beam, an x-ray unit gives much more scatter than a betatron.

TOUGHER ... and without heat treatment!

APEX

High YIELD strength TERNALLOY Aluminum Alloys

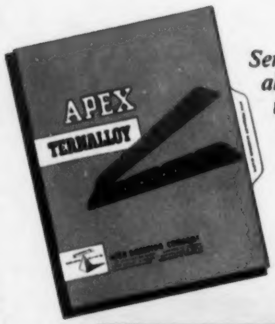


Chilicast Ternalloys 5 and 7
Room Temperature Aging

These curves are typical for all of the Ternalloys. Specific values for sand casting and Ternalloys 6 and 8 will vary slightly.

More Opportunities for Foundrymen and Engineers

- Ternalloy combines high tensile and yield strengths with extraordinary high elongations—qualities not found in other aluminum alloys.
- Affords greater accuracy of dimension, extra economy through elimination of heat treating. The metal flows smoothly.
- Adapted to the sand, plaster and permanent mold processes. May be cast in complicated shapes, its fine grain produces pressure tight castings.
- Resists corrosion, ideal for architectural and ornamental work exposed to weather. Gives long-lasting, chrome-like finish when polished.
- Available in four choices, each tailored to your specific requirements.



Send without obligation for Apex Ternalloys booklet showing as-cast properties, compositions, effect of room temperature aging, other features. Address Apex Smelting Company, 2537 W. Taylor St., Chicago 12, Ill.

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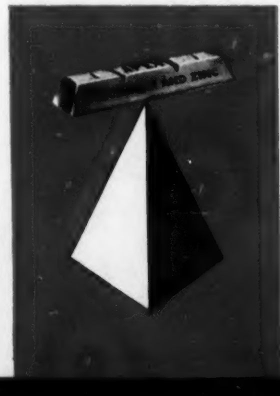

modern castings

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